THE IRON AGE

New York, June 1, 1916

ESTABLISHED 1855 VOL. 97: No. 22

Originality in a Hartford Machine Works

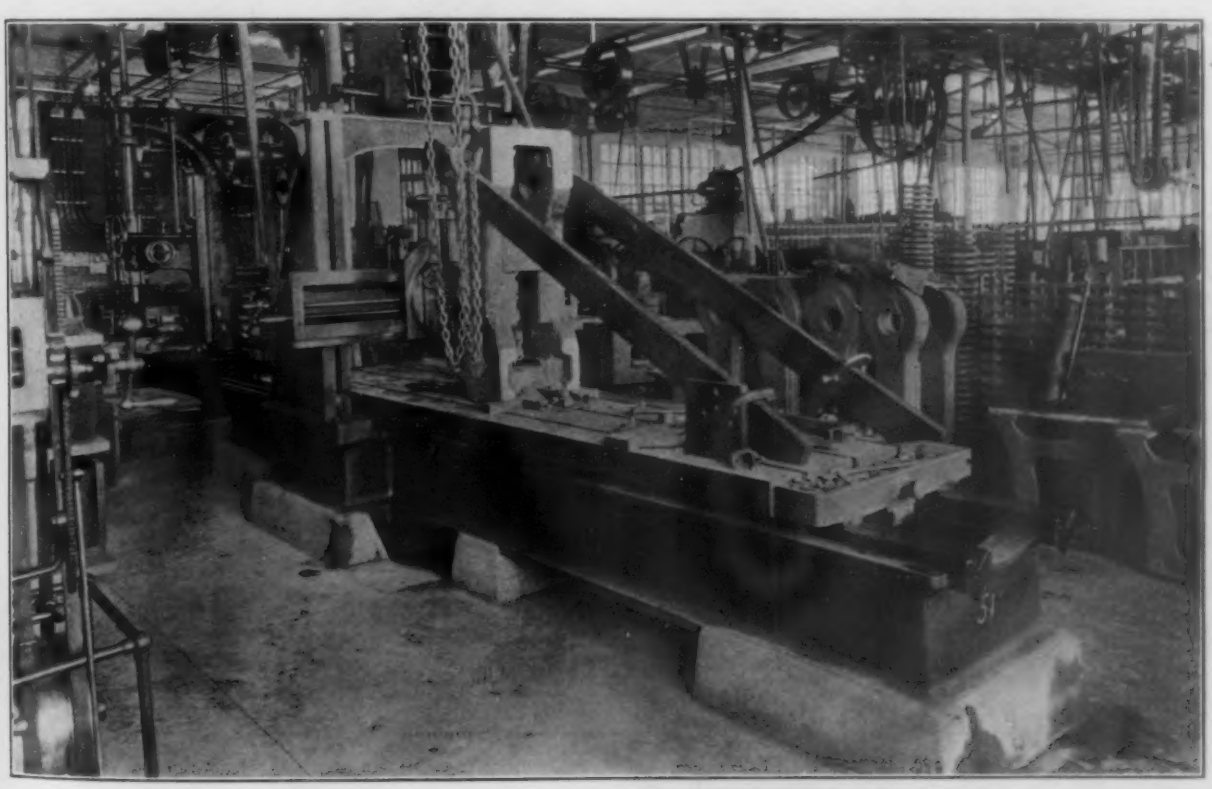
Ingenious Features of Equipment and Building of the Wood Screw Machinery Making Plant of the Asa S. Cook Company

The Asa S. Cook Company, Hartford, Conn., has been making machinery for manufacturing wood screws since 1858. Over this long period the firm has seen but few changes in working quarters or executive personnel. It has been a period of steady development and much of the progress in the specialized industry of making wood screws has been brought about by the improvement of the machinery made by this company.

Recently it built and equipped a new plant on Franklin Avenue in a residential portion of the city. The factory was carefully designed, particularly with reference to making its exterior attractive. The main building is 70 x 251 ft., one and two stories. The two-story portion has an ell, 25 x 40 ft., which is occupied by the offices, a display room and the drafting room. An ell of the one-story section, 20 x 60 ft., is used for a receiving and steel storage room. An addition, 28 x 80 ft., one story, is to be built at once to provide more room for the assembling department.

The building is of steel and brick, and a feature is the use of double channels placed back to back and separated by sections of ¾-in. pipe, cut ⅞ in. long, so that bolts ⅞ in. in diameter can be placed in the gap. All the shafting hangers in the plant are suspended to these beams by bolts, and changes can be quickly and easily made. With this construction, by the use of an eye-bolt, a chain hoist can be quickly placed to do heavy lifting, such as removing machine heads.

The shop has four main drive sections, run by a 50-hp. motor. These drives are so equipped with clutches that only a small section of the shop need



In setting up this planing machine, the legs were removed and the bed of the machine rests upon solid concrete piers. Above the floor line the piers are but little larger than the machine, but below the floor extend out about 2 ft. in each direction. The pier directly under the casting on the table of the machine comes almost directly under the point of the tool and gives considerable added rigidity to the bed of the machine

In a rack just outside the door of the superintendent's office are placed copies of current trade journals for the use of any of the employees who may desire to read them during the noon hour. The workmen take advantage of this opportunity and the periodicals are much used

be down at any time by reason of accident or any shifting of machines. The motor is mounted on a huge pyramid extending 4 ft. underground and 7 ft. above the concrete floor. The method of mounting, as one of the illustrations shows, gives a rigid support for the motor and elevates the main-drive belt above the heads of the workmen.

The factory is heated by a low-pressure boiler. The boiler room adjoins the steel room and is located below the ground level so that the drip from the heating coils returns to the boiler by gravity flow. The installation of the drip return pipe is somewhat unusual. A 10-in. vitrified soil pipe is laid under the floor from the boiler room to a pocket in the concrete floor at a point on the wall of the building directly opposite to the boiler. Through this is laid the drip pipe, cut into 18-ft. lengths. At its further end, it connects by a tee with the drip pipes from the heating coils. If it should become clogged or should need repair, it can be disconnected and pulled out through the boiler room, which is 20 ft. long, by unscrewing successively the 18-ft. sections, thus eliminating the probability that it will ever become necessary to rip up the concrete floor. The continuity of the concrete floor is unbroken by any sort of trench covering.

All current mains for power and lighting are enclosed in iron pipe. All the lights are of 100 watts and are in reflectors, the reflectors hanging below all pulleys and shafting. The arrangement is such that two lights are operated by one snap-switch. Each light has a 20-ft. radius of daylight strength.

The shop is arranged so that castings and other raw materials enter through the receiving and steel room and in the machining and assembling processes travel up one side of the factory and down

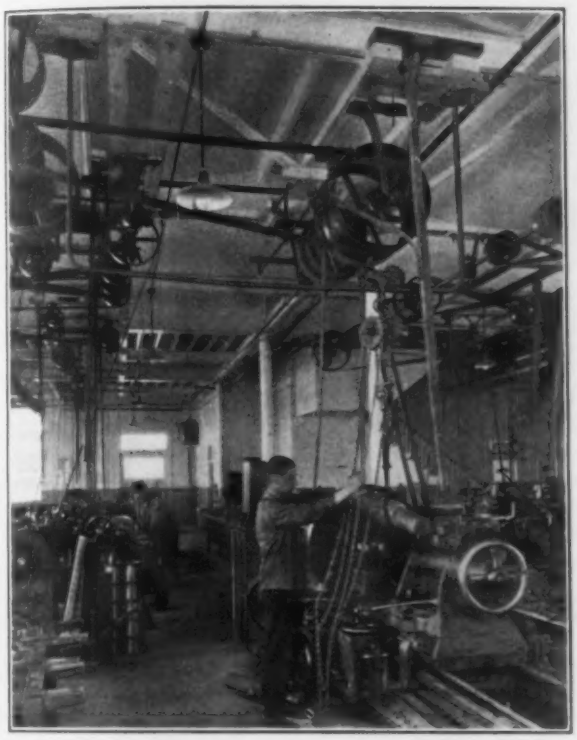
This rigid support for a 50-hp. motor, extending incidentally 4 ft. below the floor level lifts the main-drive belt above the heads of the workmen. This photograph was made before the belt guard was put in place

Drill presses are grouted into the floor with a 1-in. steel plate set into the floor in front of the machine. It will be noticed how useful this is when work is being done in large jigs

the other to the shipping door at the further end of the plant.

The use of concrete in this plant has some interesting features. By careful planning in advance, pits were left in the concrete floor in which some of the top-heavy, columnar type of machines, such as drill presses, were placed and carefully grouted in. As considerable use is made of large jigs, iron plates, 1 in. thick, were imbedded in the floor in front of the drill presses, projecting about ⅛ in. above the floor level, so that the jigs can be readily slid on and off the plates. One illustration shows how well adapted this is to the requirements of the operation.

An interesting example of an unusual machine support is seen in the illustration of the 40 x 40-in. x 20-ft. planing machine. The legs were removed from this and it rests upon concrete piers which above the floor level are little larger than the machine itself, but below the floor level extend outward about 2 ft. on each side, giving a massive, solid foundation. The pier, shown in the illustration directly under the casting mounted on the planer table, has a most useful function as it gives



For putting heavy work into this lathe, the trolley chain hoist runs upon a 1¼-in. round bar, bent U-shaped and attached to the planks overhead with 1-in. floor plates

support to the bed of the machine directly under the point where the tool is at work. The operator of this machine ran it for some years with the usual method of mounting on legs and states that it is now the most rigid planing machine he has ever run in his long experience.

Chain hoists on trolley mountings are largely employed for lifting. Several are in use designed to run upon the flanges of the girders and are quickly transferable for use upon the most convenient girder. Over the assembling section are three Coburn tracks equipped with chain hoists and there is also a similar track in the steel room. Over the largest lathe is an unique lifting arrangement consisting of a 1¼-in. round bar, bent U-shape, and equipped with a trolley chain hoist. An illustration shows this hoist, which has handled loads of over a ton. Another view shows a jib crane, a homemade quick-handling device which serves four milling machines. The crane is formed of a length of heavy pipe, supported vertically, and the swinging arm rotates about the column on roller bearings and against the thrust collars on ball bearings. The frame shown in this illustration has four milling operations and the crane is centrally located so that one man easily swings the part from one machine to another, keeping all four machines in operation.

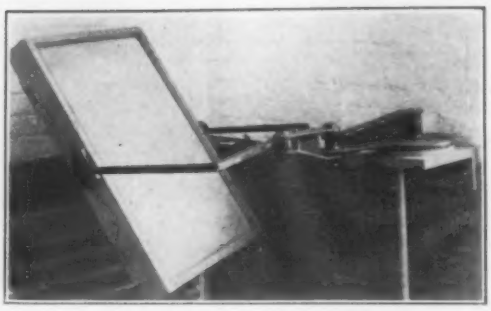
The tool room and parts-storage bins and racks are inclosed in a wire grill and occupy a large portion of the floor space opposite the assembling section. Most of the orders for the company's regular product call for large groups of machines, usually

Though not one of the regular products of the Cook Company, the women of one of the relief associations in Hartford have been helped in the task of bandage rolling by a machine for which a demand has since sprung up from other cities

for a complete plant equipment. It is planned to have always in stock enough parts and assembled machines to equip a 1000-gross wood-screw factory, so that the finished parts storage requires considerable space. Customers' requirements for parts to replace those subject to the most wear also demand that a large stock of certain parts be kept in the bins. There are some machines made by this company a generation ago that are in constant use now, as, by the nature of the operations, most of the wear comes upon comparatively few parts and these are easily replaceable.

Tote boxes of materials for machine assembling are arranged in a special rack located near the small parts storage bins. Nearby are assembly tables paralleling work benches alongside an outside wall

In place of the arbitrary numbering of parts, a custom of long standing and widely prevalent in machine manufacture, the Asa S. Cook Company is now establishing a system of numbering which identifies a specific part for a specific machine. This number is divided into two sections—the first being the machine number and the second the part number. This number appears upon the drawing, the pattern, the casting, in fact upon every place where identification is desired, including the job and cost cards and the parts price-list furnished the customer. In the products of the plant this system serves well as there are few parts common to two or more machines. It saves confusion as everything connected with the manufacture of a particular part—even the jigs used in machining it—all bear the one identifying number and no other.



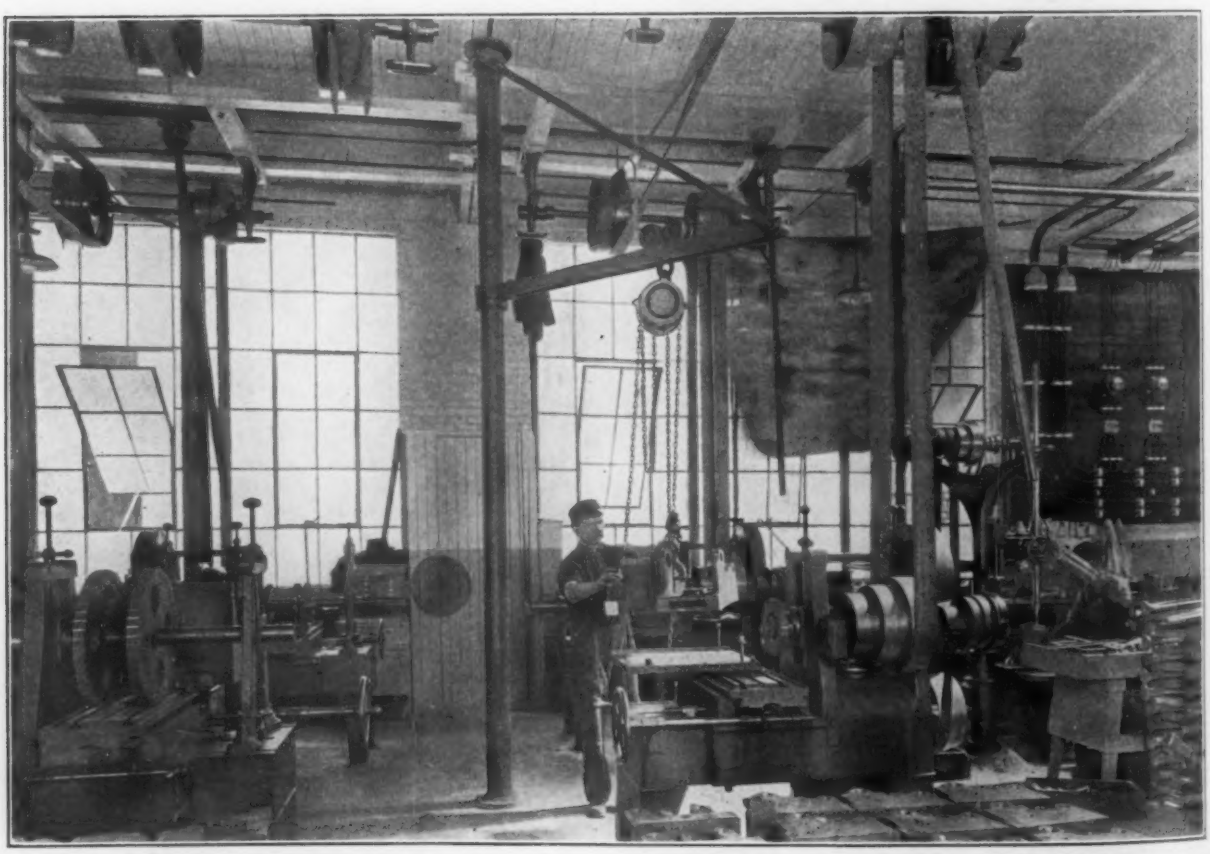
A home-made ball-bearing printing frame in the drafting room has been found serviceable and handy

The Asa S. Cook Company was founded in 1869 by Asa S. Cook, who entered the pistol factory of Colonel Colt—now the Colt's Patent Fire Arms Mfg. Company—in 1850. Here he remained for eight years, becoming foreman and then in 1858 a contractor on his own account, making machinery for the Colt and other companies. In 1858 he began the manufacture of wood screw machinery, at that time making it exclusively for one of the large companies of the day. For a year, in 1872, the business was located in one of the buildings of Pratt & Whitney; but the next year it was again moved back to its former location in the West armory of the Colt Company. Here it remained until the war business of 1915 made it necessary for the owners to take over the armory for their own use. The new factory just described was then built by the Asa S. Cook Company. The company was incorporated in 1896. Mr. Cook continued active in the business almost up to the time of his death a few months ago. The present officers are: Albert S. Cook, president and treasurer; Millard F. Cook, secretary; John F. Cook, consulting manager. R. S. Crosby is superintendent.

The company has always been engaged in the manufacture of special machinery, having built during its career machinery and machine tools of the most diverse types. This special work forms a considerable factor in its output at this time.

The regular products of the company are machines, either open or solid die, for heading screw blanks and rivets; automatic machines for pointing screw blanks and bolts, for threading stove and tire bolts, for slotting screws, and for shaving and slotting screw blanks and bolts; a hand-feed machine for threading lag screws; and a complete line of auxiliary apparatus such as ball-bearing wire reel stands, a shaver and threader tool grinder, soda water tanks and pumps, and a motor stand, especially adapted for driving wood-screw machines, which does away with overhead shafting pulleys and belting, the motor being connected by a chain belt with the main line shaft which in these machines is located below the machine tables.

The field for these machines is constantly extending as manufacturers of various types of screws and bolts discover that it is possible to use wire of the thread diameter, instead of the larger head diameter, upset the head in a header, and secure at smaller cost a serviceable product.



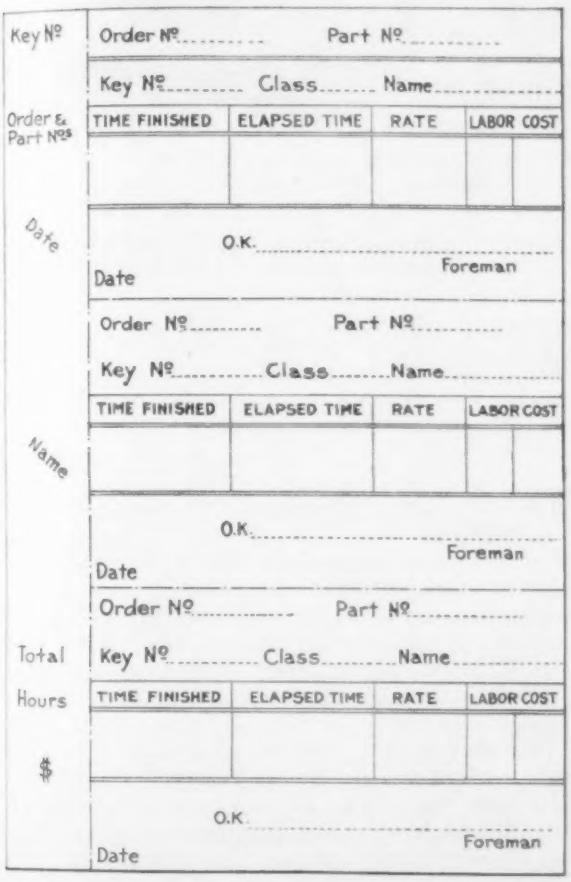
This shop-made jib crane is formed with a vertical column of heavy steel pipe and a swinging arm which rotates about the column on roller bearings and on ball bearings against the thrust collars. On the frame shown suspended by the chain hoist, there are four milling operations. One man easily swings the frame from one machine to another and keeps all four machines in operation

TIME-SAVING TIME SYSTEM

Job Coupons for Compiling Routing Papers and Stubs for Making Up Pay Rolls

BY THOMAS J. WALSH

The form submitted herewith may be called a coupon time card. The coupon arrangement permits the separation, classification and filing of the coupon job cards in any manner desired. In order to understand the method of operation fully, a description of the incidental detail may be appended.



A Coupon Time Card Which Gives Opportunity for Keeping Job Labor Cost Records and Checks on the Payroll Calculations

The time cards are issued daily to each foreman, with the key number, class number and rate symbol inserted. This information is obtained from lists of employees grouped under each foreman. These lists indicate the key number, class number, rate and rate symbol of each employee. Different colored cards may be used for each block of rates, as a safeguard for accuracy in the cost extension. The foreman inserts the order number and part number on which the employees are to start work each morning, and the card is hung over the employee's bench or machine. As each job allotted to the employee is finished, the time is inserted and the order and part number of the next job is inserted on the next job coupon.

For convenience the time card is arranged with three coupons; that being the average number of jobs worked on by one employee per day. If he works on more than three jobs, more coupons are used.

The cards are then collected at the end of the day or the following morning and sent to the time clerk. The latter extends the elapsed time, as reflected by each coupon. A clock arrangement is used as an aid in this. A numerical designation is allotted to each quarter hour to facilitate the subtraction. For example: a job started at 7:30 a. m. and finished at 9 a. m. Subtract 8, the designation for 9 a. m., from 9 2/4, the designation for 7:30 a. m., and the remainder is 1 2/4 hr. At the same time the labor cost extension is made. The total of the job coupons for the day is entered on the payroll coupon on the left of the time card. Thus is obtained an absolute proof of payroll and labor charged to the work in process. Every cent paid the employee is properly accounted for in an immediate and automatically correct manner. The coupons are then cut and the job coupons are filed card index fashion in a cabinet provided for the purpose.

Guide cards indicate each part number of the order, and the job coupons are filed in their proper section. When the part is finished the job coupons are then summarized. The guide card may be used as the summary card; by so doing the cost of completed part is always available and is especially valuable for comparative purposes, when a repetition order is going through the works. It will be seen that recording the time on order sheets is no longer necessary. Accurate, immediate and positive results are obtained on completion of each operation on each part, and any difference in cost is at once shown up. Another and very important result obtained is the knowledge of the status of each part. The job coupons may be manipulated so as to act as automatic reporters of the starting and finishing of each operation on a machine part, and not alone is the exact location of the part shown, but the man who actually is or was working on it at any given time. Dispatching and routing reports may be compiled from the job coupons.

The payroll coupon may be placed in an envelope and footed at the end of the week or entered in the payroll daily. If the employee's rate is shown on the envelope or payroll, a safeguard will be established against errors in extension or rating. For example, if a man's weekly wage for 54 hr. is $18 and is so shown on the envelope of payroll, and the footing of the payroll coupons discloses a different amount, it becomes evident that an error has been committed in the computation of the job cards.

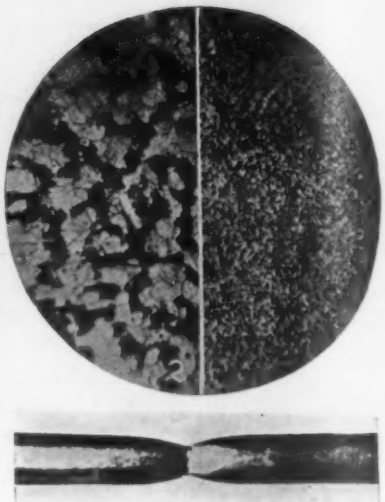
The order and part numbers shown on this coupon (for the payroll) are inserted to facilitate the correction of such errors, and for statistical purposes. The use of colors for the rate tables is suggested. They not alone act as an aid to accuracy, but when the colors are mastered accelerate the extension of rates.

Germany and Norway's Iron Mines

The chairman of the Sydvaranger Mining Company of Norway is quoted to the effect that the German loan to a banking syndicate there some years ago was coupled with the condition that the North German Bank have the right of pre-emption for its clients as to a portion of the iron-ore output. Because of economic changes due to the war and of a conflict of interests likely to arise after it, the directors decided that the loan should be redeemed so as to sever this connection. It has been taken over at 100 per cent. It is stated as improbable that a Norwegian banking syndicate would have granted so favorable a loan to a new mining company.

Holland's imports of pig iron in 1915 are reported at 46,608 tons against 208 562 tons in 1914; of finished iron and steel, 525,033 tons against 636,197 tons in 1914; of rails 26,222 tons against 49,286 tons in 1914, and of steel bars and rods 33,258 tons against 166,878 tons in 1914. Exports show the same wide spread, only 4055 tons of pig iron being exported in 1915 against 126,426 tons in 1914.

Fig. 1 shows the microstructure and the appearance of a broken test bar of under-annealed, mild cast steel, revealing the incomplete transformation of the arrangement of the crystals, resulting in an absence of cohesion between them. The peculiar wavy or mottled fracture always accompanies such a fracture, the static properties being excellent. Fig. 2 shows the microstructure of the same steel annealed by the slow-cooling (left half) and quick-cooling method (right half) with the appearance of the broken test piece. The contrast between these and those of Fig. 1 is manifest, the latter being by far the stronger. The photomicrographs in this article are reduced one-third from an original magnification of about 100 diameters.



Steel Castings and Physical Properties

Good Static Results Do Not Always Indicate the Best Steel—Some Practical Examples—Initial Structure, Kind of Annealing and Dynamic Tests

BY EDWIN F. CONE

STATIC tests are often misleading. This is especially true of steel castings. Tests which show superior elongation, in particular, and unusually good qualities besides, do not always mean the best steel. So many conditions affect the results so decidedly that conclusions from any one set of tests from any one foundry or kind of steel, electric or otherwise, are really unreliable unless essential facts are known. Annealing, initial microstructure, the process, the rate of cooling—all are factors affecting the static properties of steel castings.

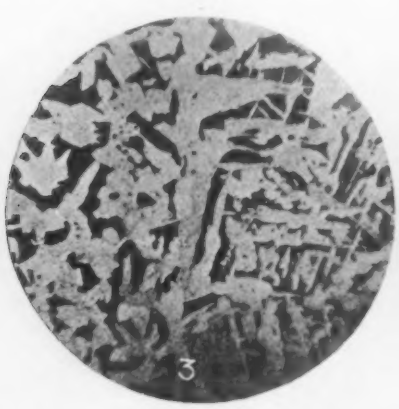
These observations are based on the fact that better physical tests *per se* are more often secured from cast steel just under-annealed than from the same steel heated to the proper temperature and cooled slowly. It is also true that a certain initial structure persists through the annealing, so that different sections of steel from the same heat present varying results. This was discussed by the author in an article in THE IRON AGE, Dec. 2, 1915, entitled "The Initial Structure of Steel Castings." Striking illustrations of these two points were brought to the attention of the writer in his experience as a metallurgist for a large steel casting producer.

It was so often stated that the static tests from one particular foundry were so much superior to those from another foundry under the same management that a campaign was made to ascertain the cause. The latter may be designated as Foundry No. 1 and the former as Foundry No. 2. Both foundries were making acid open-hearth steel castings and both were making locomotive castings as well as other.

A series of test bars from locomotive driving-wheel centers were obtained from Foundry No. 2. They were taken from the castings after they had been through the annealing process as practiced at that foundry. This consisted in bringing the steel to what appeared to be somewhat in excess of the recalescence temperature and then, after proper soaking, to cool them suddenly in the air. An examination of these bars resulted as indicated by Table 1.

A comparison of these tests with the average of those obtained from Foundry No. 1, the one at which the writer was employed, and from the same steel as to composition, showed that the former were better both as to ductility and elastic ratio.

The chemical analysis revealing no cause for this, a microscopical examination was made. This



Photomicrographs, Figs. 3 and 4, Represent the Structure of the Steel from the Last Two Tests in Table 1 Showing the Unannealed Condition of the Steel, Though the Static Results Are Excellent. Fig. 5 is the microstructure of steel from Foundry No. 2 annealed by quick cooling from above the recalescence point.

Figs. 6 and 7 Are Photomicrographs of Under-annealed Cast Steel from Foundry No. 1, and represent the First Two Tests in Table 2. The incomplete change in structure is very manifest with static results again excellent. Fig. 8 is the structure of the same steel cooled quickly from above the recalescence point. It represents the sixth test of Table 3.

brought out one of the causes. It is now recognized, as illustrated by comparative photomicrographs which introduce this article, that under-annealing —the heating of medium carbon steel castings to just under the rescalescence point, instead of over— will invariably result in unusually good static properties. Photomicrographs, Figs. 3 and 4, show the structure of the steel in Table 1 as heat-treated at temperature, showed unusually good results, averaging about as follows:

			Per Cent
Tensile strength, lb. per sq. in..	74,500	Carbon	0.28
Elastic limit, lb. per sq. in.....	45,000	Manganese ..	0.64
Elongation in 2 in., per cent....	30.0	Silicon	0.304
Reduced area, per cent.....	50.6	Surplus	0.044
Elastic ratio, per cent.....	60.4	Phosphorus .	0.030

Here the elastic ratio is high as well as the ductility, and the tensile strength is also high for the

Table 1.—Static Properties of Some Steel Castings from Foundry No. 2

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2-In., Per Cent	Reduced Area, Per Cent	Elastic Ratio, Per Cent	Carbon, Per Cent	Manganese, Per Cent	Silicon, Per Cent	Sulphur, Per Cent	Phosphorus, Per Cent
74,000	42,500	30.0	50.6	57.43	0.28	0.64	0.334	0.044	0.028
68,500	40,500	29.5	52.0	59.10	0.24	0.64	0.378	0.054	0.027
69,500	39,500	30.0	50.0	56.83	0.25	0.65	0.278	0.048	0.031
69,500	39,500	31.0	50.3	56.11	0.24	0.64	0.282	0.055	0.029

In these and all other tests in this article the elastic limit was determined by the drop of the beam, checked by dividers.

Foundry No. 2, where the superior tests were cited. It is readily seen that the original structure is not entirely broken up, but only partly so.

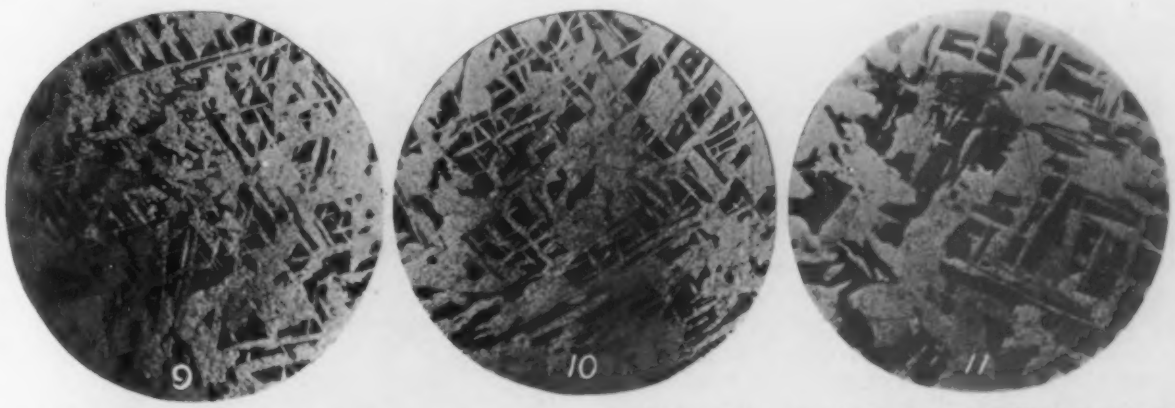
A peculiar characteristic of such physical tests is that they almost always possess an unusual fracture. Fig. 1 illustrates both the fracture and the structure in such cases. It is mottled or wavy along the outside surface of the broken test bar as against the smooth rounded surface of properly treated bars shown by contrast in Fig. 2, whether the steel be annealed by the slow or quick-cooling process. Without question while such steel, under-annealed, shows apparently fine static properties, it cannot be properly contended that it is as good steel as steel completely annealed, and hence more firmly knitted together but usually giving less proportionate elongation and other properties.

Steel from Foundry No. 2 carried to the proper composition. The microstructure of this steel has the expected fine grain shown by Fig. 5, caused by quick cooling from above the recalescence point, a method of annealing whose results it is not right to compare with those from slow cooling. The structure, however, is not as fine as that in Fig. 2. It is therefore evident that the excellent physical results from Foundry No. 2 are due to two causes:

1. Under-annealing.
2. Quick cooling.

The first cause prevailed in the majority of the cases due to improper annealing, while from the other cause the superiority of the results was due in part to the method of annealing, that of Foundry No. 1 being the slow cooling process.

The next step in the investigation was to make trial runs in annealing similar castings at Foundry



Photomicrographs, Figs. 9 and 10, Represent the Initial Structure of the Steel in Test Bars on Driving-Wheel Centers from Foundry No. 2 as Compared with the Same Steel from Foundry No. 1. Shown in Fig. 11. The finer structure of the former as compared with the latter is the point, revealing less ingotism. The effect of this difference in initial structure is important.

No. 1 by the quick-cooling method as used at Foundry No. 2. A small annealer was charged with various driving-wheel centers and brought up to a temperature just under the recalescence point. The results of bars tested from these wheels are given in Table 2:

Table 2—Static Properties of Driving-Wheel Centers Under-Annealed at Foundry No. 1

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., Per Cent	Reduced Area, Per Cent	Elastic Ratio, Per Cent
68,000	40,000	29.0	50.6	58.8
77,000	41,000	26.5	40.3	53.2
68,500	36,500	29.5	46.3	53.4
60,500	37,000	34.0	57.3	61.1
69,500	35,500	26.5	47.8	51.0
80,000	42,000	26.5	41.9	52.5
72,000	36,000	26.5	52.0	50.0
75,000	38,000	25.0	37.2	50.6

The fracture of all of these bars had the characteristic wavy appearance illustrated by Fig. 1, and the microstructure was that revealed by Figs. 6 and 7 taken from two of the above tests. These are beautiful to look at, and strongly resemble Fig. 1.

Bringing another set of the same castings to the proper temperature and cooling them quickly in the air resulted in the tests given by Table 3.

Table 3—Static Properties of Driving-Wheel Centers Annealed by Quick-Cooling at Foundry No. 1

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., Per Cent	Reduced Area, Per Cent	Elastic Ratio, Per Cent
80,000	47,000	26.0	38.8	58.75
81,000	55,000	24.5	38.6	68.00
76,500	46,000	25.5	44.9	60.13
73,000	39,000	25.5	38.8	53.42
74,000	45,500	26.5	44.4	61.48
76,000	48,000	26.5	46.3	63.15
75,500	38,000	27.0	40.3	50.33
76,000	45,500	27.5	44.9	60.00
79,000	51,000	22.0	34.1	64.55
75,000	42,000	26.0	40.3	56.00
72,500	42,500	28.0	47.8	58.62
72,000	41,000	27.0	41.9	57.00

Regarded as a whole these tests are better than the general average of those obtained from the same steel slowly cooled, though there are exceptions. The general average of the elastic ratio is higher than with the slow-cooling method, and in most cases the elongation is better. Compared with the same kind of tests from Foundry No. 2 they are inferior in every respect, being lower in elongation, reduced area, and especially in general uniformity. Under the microscope these tests show practically the same structure as those of Foundry No. 2, Fig. 5. The microstructure of most of them is that of Fig. 8 taken from one of the bars. The character of the fracture more nearly resembled that of a forging.

It being established that under the same and proper annealing conditions, steel from Foundry No. 2 gave better physical results than that from Foundry No. 1, the cause was suspected to exist in the initial structure of the steel. Certain unannealed test bars from wheel centers from Foundry No. 2 had the following physical properties:

Tensile Strength, Lb. per Sq. in.	Elastic Limit, Lb. per Sq. in.	Elongation in 2 in., Per Cent	Reduced Area, Per Cent	Elastic Ratio, Per Cent
67,000	36,500	31.5	47.8	54.48
67,500	37,500	30.0	46.3	55.55

These bars had an initial microstructure represented by Figs. 9 and 10.

The initial microstructure of the same steel poured under the same conditions from Foundry No. 1 is shown by the photomicrograph Fig. 11. The contrast is marked. There is more of an absence of very large crystals of either ferrite or pearlite, and the presence of the network structure, usually never found in Foundry No. 1 steel, except under conditions discussed in the article previously referred to in THE IRON AGE, Dec. 2, 1915, is manifest. Cast steel, in which ingotism or a large initial microstructure is generally absent, always gives superior static results, persisting through the heat treatment no matter what its nature. It is to be deduced, then, that its absence from the steel from Foundry No. 2 accounts partly for the better physical results of the latter. The reason of this absence is difficult to determine when it is considered that like castings, as to size and shape and process of manufacture, were compared. It is hardly probable that the initial temperature was the cause, but it was more likely due to the fact that the steel was made in smaller furnaces. The conditions surrounding the melting of steel, such as size and kind of furnace, temperature of pouring, etc., have an influence on the initial structure that is unsuspected by many and that has an important bearing on the static properties.

Figs. 12 and 13 Are Photomicrographs of Mild Steel Castings Which Passed U. S. Government Specifications but Were Not Fully Annealed. Fig. 14 shows the structure of a cast-steel hook which broke in service, due to under-annealing.

A recent illustration of poor steel with excellent static properties is contained in a paper on the "Metallography of Steel for United States Naval Ordnance" presented by Lieut.-Commander Harold E. Cooke of the United States Navy, naval inspector of ordnance, Midvale Steel Company, Philadelphia, before the meeting of the American Institute of Mining Engineers last February in New York. Commenting on steel castings in general Mr. Cooke cited two photomicrographs, reproduced here as Figs. 12 and 13, as revealing:

The structure exhibited by a test specimen of a class B casting which passed the (Navy's) physical test, giving the following results:

Tensile strength, lb. per sq. in.	70,500
Elastic limit, lb. per sq. in.	36,000
Elongation in 2 in., per cent	27.5
Reduced area, per cent	49.2
Elastic ratio, per cent	51.6

This was an 0.26 per cent carbon, simple steel casting, and had been held at a temperature supposed to be 1650 deg. Fahr. for 22 hr. and cooled for 17 hr. It pre-

sents the characteristic structure of an ingot. * * * It is not understood how such good results were obtained in elongation and reduction of area with such a poor microstructure. * * * The upper critical temperature was probably never reached in the treatment of these castings.

Mr. Cooke's conclusion is correct, but it is also true that this is only another case where poor annealing of mild cast steel produces fine static results, even to the extent of easily passing carefully formulated Government specifications, and yet the steel was not reliable. Many tons of just such steel has been accepted by the Government.

An interesting illustration of the dangerous results that may proceed from under-annealing, though the steel itself may give apparent excellent static results, was that of a large broken cast-steel hook in one of the foundries mentioned. It was the custom of that foundry, as of many others even today, to pour its own hooks for the chains on its cranes. This one, a very large one, broke while lifting an unusually large casting. Its microstructure is shown by the photomicrograph, Fig. 14, which displays the characteristic structure of unannealed cast steel, usually giving static properties. Its similarity to Figs. 1, 6 and 7 is very evident. Its composition was carbon, 0.29; manganese, 0.66; silicon, 0.285; sulphur, 0.33 and phosphorus, 0.30 per cent—normal in every respect.

Another factor entering into the question of the effect on the physical tests of steel castings is not only the extent and method of annealing but the fuel employed. At Foundry No. 2, not only were the castings cooled quickly but the annealer was fired with coke under a forced draft, whereas at Foundry No. 1 the fuel was bituminous coal under natural draft. To what extent this difference may have affected the static properties of the steel we are comparing, it is impossible now to determine. It is believed, however, that in this case it was not important. It is known that the fuel used and the conditions employed do have at times an important bearing. Recent experience is understood to have shown that steel annealed in an electrically heated furnace has superior physical properties and different from those of the same steel annealed with coal, coke, oil or gas.

The conclusion of the whole matter is that the static results of steel castings cannot always be taken at their face value. To say that such and such a cast steel, converter or open-hearth, is better than electric or crucible steel, or just as good, because a certain set of physical tests seem, on paper, so to indicate, is wide of the mark. The underlying conditions and the history of the steel must be known. Comparisons can be made only when the history or conditions in each grade of steel are as near the same as possible.

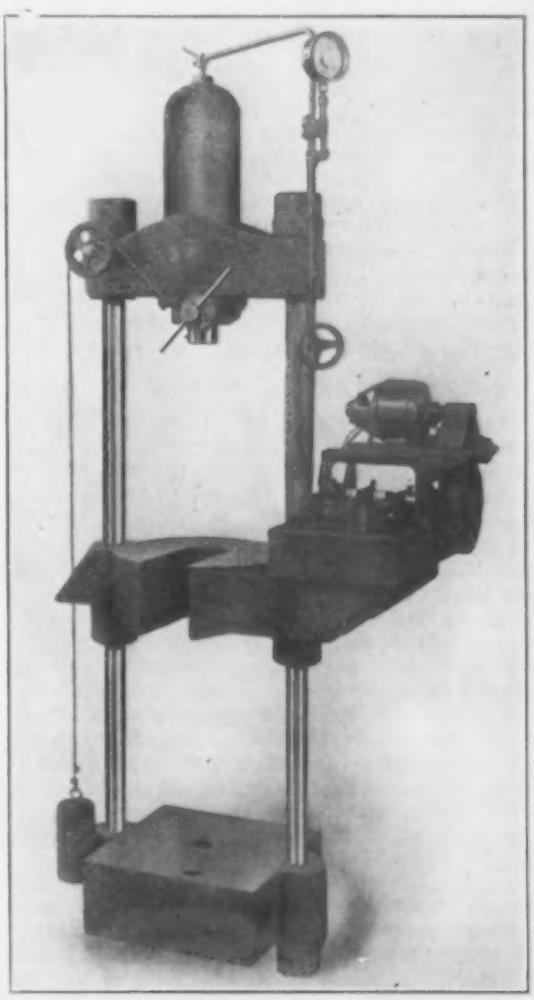
More reliable than static tests of such steel are dynamic tests which, if applied to any of the foregoing cases, would have revealed immediately the inferiority of the under-annealed to the properly annealed castings. Steel such as that represented by Figs. 1, 3, 4, 6, 7, 12, 13 and 14 would give by no means the stress or endurance results of steel properly annealed.

The unsatisfactory nature of static tests as compared with dynamic in determining the real value of a piece of steel has been the subject of some discussion among experts. Suggestions have even been made that the latter supplant the former. It is true that the microscope is a sure guide always, as illustrated by this discussion. It is also significant that some specifications are now requiring dynamic or microscopical tests, or both, supplementary to the static.

Dual Purpose 100-Ton Hydraulic Forcing Press

The hydraulic press shown in the accompanying illustration has been brought out by the Hydraulic Press Mfg. Company, Mount Gilead, Ohio. It is designed for two distinct forcing operations, for forcing locomotive piston rods into the piston heads, and for removing the piston head from the piston rod. It is of course adaptable to much of the forcing work coming up in general machine, repair, automobile and railroad shops. In this may be included arbor and broaching work, the open slot in the press proper allowing space for the arbor forcing operations and providing a place for a broach to pass through.

The press is constructed in two parts, the upper part having a maximum pressure capacity of 100 tons and the lower part 50 tons. For forcing the piston head on, the piston head is set on the lower base with the rod passing up through the press base proper. The pressure then applied from the end of the piston rod, forcing it into the piston head. When the press is used for forcing the piston head off the rod, the piston head with the rod is hung on the press base proper and the pressure applied from the end of the rod, forcing the rod out of the piston head. More pressure is required for the latter operation. The upper part of the



Press Capable of Two Distinct Forcing Operations

press is thus designed for a maximum pressure of 100 tons.

The usual method of installing this press is to erect it so that the base of the press proper is just above the floor level, the lower parts of the press being under the floor. The pressure is furnished by a direct motor-driven horizontal double-plunger pump with double gear reduction. A tee screw hydraulic operating valve controls the pressure from this pump to the press cylinder. The diameter of the press ram is 10 in. It has a run of 22 in. and is equipped with a rack and pinion attachment for raising or lowering the ram upon the work.

Iron, Steel and Hardware Convention

Henry Bodevin New Head of Organization —Business Prospects and Problems of Distributers Discussed at Pittsburgh Meeting

The American Iron, Steel and Heavy Hardware Association concluded a successful convention at Pittsburgh, May 26, after a meeting covering three days. At the final session officers were elected as follows:

Henry Bodevin, N. Langler & Sons, Brooklyn, N. Y., president.

E. F. Yarnelle, Mossman, Yarnelle & Co., Fort Wayne, Ind., first vice-president.

F. H. Butts, Butts & Ordway Company, Boston, Mass., second vice-president.

W. E. Bittenbender, Bittenbender Company, Scranton, Pa., and W. H. Grant, Bonniwell-Calvin Iron Company, Kansas City, Mo., members of the executive committee.

Following the preliminary address, to which reference was made in THE IRON AGE of May 25, the convention was addressed by Congressman Daniel B. Stephens, of Nebraska, whose topic was the Stevens bill, after which the following nominating committee was appointed:

Charles A. Faeth, Faeth Iron Company, Kansas City, Mo., chairman; C. R. Williams, Williams Hardware Company, Minneapolis, Minn.; A. C. Harvey, Arthur C. Harvey Company, Boston, Mass.; George C. Jensen, Spotswood-Helfer Company, San Francisco, Cal., and J. W. McGinness, Pittsburgh.

The Wednesday afternoon session, which was executive, was devoted to the consideration of reports by the secretary-treasurer, A. H. Chamberlain; the executive committee, Henry Bodevin, chairman; the horseshoe committee, Herbert Field, chairman; the bolt and nut committee, E. J. McCarthy, chairman, and the wheel and wood stock committee, Calvin Sohl, chairman.

DISCUSSION ON THE BUSINESS OUTLOOK

The association convened in executive session Thursday morning, and the reports of the pad committee, W. R. Wilson, chairman; nail committee, John S. Proctor, chairman; calk committee, H. E. Treadway, chairman, and the insurance committee, C. M. Roehm, chairman, were presented.

C. M. Roehm, Roehm & Davison, Detroit, Mich., spoke briefly, giving his views of the outlook for business in iron, steel and heavy hardware. Mr. Roehm referred to the enormous demand for iron and steel products, the high prices ruling, the difficulty in getting deliveries from the mills. He said that in his opinion many of the mills have taken more business than they should, while, on the other hand, a good many jobbers have placed orders for more goods than they really wanted, because of fear they could not get deliveries and might run short of stock.

F. H. Butts, of the Butts & Ordway Company, Boston, said, in part:

I see nothing discouraging in the outlook for the immediate future, as I believe that should the market fall off, prices will be reduced gradually, for the reason that merchants and mills are working in harmony. The Carnegie warehouses scattered throughout the country have, in my opinion, been beneficial to the trade, as they have had a steadying influence on the markets where they have had the co-operation of local distributers.

What will happen when the war is over? I, for one, cannot tell. It seems to me, however, that should this country not establish a high protective tariff, it will be flooded, just as we were in 1914, with low-priced products of foreign mills. This country is probably the only one strong enough financially to absorb foreign surplus. We are now manufacturing all classes of goods at the highest cost for labor and material ever known. If we are to have labor in this country the highest paid of any in the world, we certainly must have a high protective tariff. With a high protective tariff, and continually increasing uses for steel, we may feel sure of a continuance of a fairly high scale of prices.

Also speaking on the subject of the future of the iron and steel business, James A. Coe, James A. Coe & Co., Newark, N. J., estimated the distributers' or jobbers' share of the total production of steel products in which they specialize at 10 per cent, or 1,600,000 tons, which divided among 200 distributers means that each will handle an average of 8000 tons per year, or 666 tons per month. He went on to review existing conditions as to prices and deliveries, and their adverse effect on jobbers, incidentally remarking that such conditions cannot long prevail, and that jobbers should get their stocks in shape to supply normal demands; also that they should buy on recessions of the market.

STEEL MILLS DOING THEIR BEST

In the discussion which followed the papers of Messrs. Butts and Coe, Edward F. Yarnelle, Mossman, Yarnelle & Co., Fort Wayne, Ind., said the present high prices of iron, steel and heavy hardware were controlled entirely by the old law of supply and demand. In the matter of deliveries he said he believed that the majority of the mills are doing the best they can under trying conditions, and that only in a few cases were they favoring customers with prompt deliveries in order to obtain premiums in prices, to the detriment of regular customers who placed contracts some time ago yet are not getting satisfactory shipments. He believed that when the war was over there will still be an immense demand on this country for iron, steel, machinery and other products from countries whose manufacturing resources have been crippled. He said that a tariff to prevent large importations of iron and steel products into this country is necessary, as Germany and other countries will be in a position to send their products over here, in spite of the crippled condition of their mills. He also said that a readjustment of values will be necessary when the war is over, but he did not look for serious trouble, and believed that conditions would right themselves quickly.

RAILROADS ENABLED TO BUY

Mr. Yarnelle was followed by Charles C. Cluff, manager of sales of the Carnegie Steel Company, New York. Mr. Cluff said that the nominal price of bars and shapes of the Carnegie Steel Company at present is 2.50c., f.o.b. Pittsburgh, and that so far as he knew none of the offices of the Carnegie Steel Company has taken any orders at premium prices. He said that for some time the Carnegie Steel Company had been booking orders for its materials for delivery at its convenience, and that most of the orders booked recently would not be delivered until early in 1917, if present conditions last. Mr. Cluff said that even should the war terminate on short notice, he believed there would be a heavy demand for iron and steel products, but probably at lower prices than are ruling now. He said that in normal times the railroads use close to 50 per cent or more of the iron and steel made in this country, and with the wonderful revival of business, railroad earnings had been heavy, and the railroads were again in position to make large purchases of locomotives, cars and track materials, and he believed they would do so. He referred to the fact that this country is getting richer, its foreign markets have been very much extended, particularly since the war started, and that in the case of the Steel Corporation, it had built up a tremendous trade abroad, which it would not only endeavor to retain, but to extend.

The association again went into executive session Thursday afternoon to receive the following reports: Iron and steel committee, by James A. Coe, James A. Coe & Co., Newark, N. J.; automobile accessories, by R. R. Englehart, Sieg Iron Company, Davenport, Iowa; on public policy, by A. K. Edwards, Edwards & Chamberlin Hardware Company, Kalamazoo, Mich.; on the cost of doing business, by W. A. Kemmerer, Bitten-

bender Company, Scranton, Pa.; spring and axle committee, by W. L. Niekamp, Beck & Corbitt Iron Company, St. Louis, Mo.; bulletin committee, by E. P. Sanderson, chairman, E. P. Sanderson Company, Boston, Mass., and transportation committee, by W. J. Dean, Nicols, Dean & Gregg, St. Paul, Minn. In part Mr. Dean's report said:

It has been suggested that this committee might handle overcharges and other matters of similar nature, but we believe this can be done much better by the shippers themselves or by the traffic committees of the various local trade associations.

There is one subject which we think is worthy of consideration by the association, and that is the matter of uniform classification. It seems strange in a country like ours where joint tariffs exist to a large extent, and where the interchange of traffic between transportation companies is universal, that freight should be moved under five different classifications. Would it not simplify matters very much both for the shipper and the carrier, if there was only one classification for the entire country? Would it be a hard matter to induce the railroads to join in a movement with this end in view? Can we not secure the co-operation and assistance of the Chamber of Commerce of the United States to bring this about?

The report submitted by W. A. Kemmerer, for the committee on cost of doing business, was in part as follows:

CO-OPERATION OF SALES AND CREDIT MEN

"The most costly thing in the world is experience. Nothing that we possess has cost us quite as much, and even after we have secured it, much of it is of no value except as a warning or a punishment. Especially in business, the cost of experience is a big item, and one of the main reasons why 95 per cent of business men fail. To cut the cost of experience is a most important subject. It can be done by studying the mistakes of others and getting away from the habit of learning only by experience, and by studying the value of training.

"There has been a mass—I might say a mess—of material written on the subject of profits. It is surely a knotty problem, and some of the attempted solutions only seem to tie the knots tighter. Every detail of a business should be treated exhaustively in this cost of doing business problem, and one of the essentials is that one big all-absorbing problem—stoppage of leaks.

"We are continually confronted with new systems, some very elaborate, but all designed toward reducing labor and saving of expense in the handling of various details. Many of these so-called systems are worthless, an expense without results. It is well to remember that the definition of system differs with various temperaments. To some it means how near to machine-like precision it is possible to reduce the labor of a human being. To others it means the arrangement of various details and duties to reduce energy and expense. The necessity of dissecting new systems before their adoption is obvious.

"The relationship of the sales department to the credit department has its important place in our cost system. Warfare between sales and credits is a condition to be found in many concerns. What we want is credit and sales departments co-ordinated.

"If the credit man does not give utterance to the statement that if it were not for his experience or system, judgment of human nature, and firmness in turning down orders, the sales department would soon bankrupt the company, he at least reflects this thought in his actions; and then we may hear the sales manager utter a conceited statement embodying the idea that if it were not for his selling methods, etc., a credit man would not be needed, for there would be no orders, and, in fact, he is obliged to obtain business in spite of and not at all on account of the credit department. It is here where some sales managers lose that co-ordinate thought without which co-operation cannot be maintained to its full efficiency.

EXECUTIVES MUST LEAD THE WAY

"Salesmanship must emanate from the man at the top, and must be found in the talks and correspondence of not only the sales department, but also the credit and other departments. The management and the office executives are responsible for creating the atmosphere where real salesmanship thrives, for the men on the road reflect methods allowed by the house.

"Placing upon the credit department a fixed responsibility toward the sales department takes into consideration that all departments are working together for the good of the whole. Equally, the same responsibility rests with the sales manager toward the issuing of credits and proper collection of accounts.

Henry Bodevin, N. Langler & Sons, Brooklyn, N. Y., elected president of the American Iron, Steel and Heavy Hardware Association at Pittsburgh Meeting

"The question of leaks which exists in every concern to a greater or less degree, depending on the efficiency of the management, is a big problem. Is it not a fact that a big problem isn't really a big problem but just a collection of little problems, and in order to solve the big problem the shortest and best way is to analyze it into a lot of little problems and go after each one separately? So when we go after the leaks in our business let us pick them to pieces and try to find the answer to each little problem.

"To keep a complicated system of costs and accounts, to put the results in the shape of a systematized report each day or week or month, and then to have those responsible glance at the sheet and merely remark 'Gross profit was a little off last month. Overhead is running a little higher. Well, it might be worse,' and file it all away for future reference—well, that sort of a system serves about the same purpose as the morocco bound volumes with uncut leaves you sometimes find on the book shelves of newly-made millionaires.

"The man who constantly uses his result sheet to smoke out as many of the little problems affecting adversely his volume of profits is never likely to run against a problem too big to be tackled and solved. Figures often lie to the one who doesn't get beneath their surface—but they talk to the one who burrows down among them and gets acquainted. Study your result sheets; it saves worry and profit."

The concluding session on Friday morning was an open session, devoted first to the election of officers and to a selection of a place for the 1917 convention. New Orleans, La., was chosen, and it was suggested that to insure favorable weather the meeting next year be held in April instead of May, and this probably will be done. Votes of thanks were rendered to the Pittsburgh entertainment committee, to J. A. Gregg for his services as president in the past year, and to the management of the William Penn Hotel.

The entertainment program was as replete as that prepared for the triple convention of machinery and supply men held in Pittsburgh three weeks ago. The Pittsburgh entertainment committee was the same as won such praise from the delegates to the triple convention. Col. H. P. Bope, vice-president of the Carnegie Steel Company, was chairman of the committee.

Among the features were a reception and ball, a banquet, a boat trip to the Duquesne plant of the Carnegie Steel Company and the McKeesport plant of the National Tube Company. Colonel Bope was toastmaster at the banquet. He was introduced by J. A. Gregg, the retiring president. The speakers were E. F. Yarnelle, Dr. John A. Brashear, J. A. Brashear & Co., Ltd.; A. W. Douglas and J. T. Holsworth, dean of the School of Economics, University of Pittsburgh.

Milling Machine for Manufacturing Work

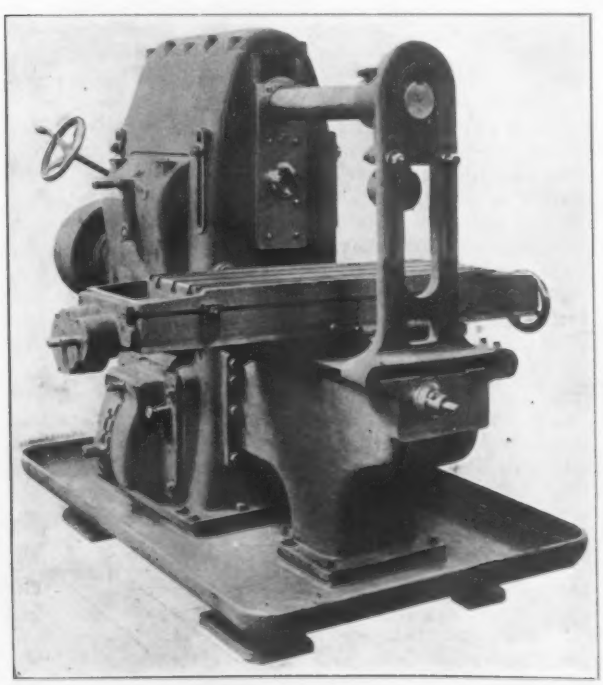
The National Transit Pump & Machine Company, Oil City, Pa., has brought out a milling machine designed primarily for manufacturing work, and shown in the accompanying illustration.

The column, or main frame, is of box-section design. The guides for the spindle heads are four separate box sections. The front head guides are finished on the inner edge, forming a narrow guide for the spindle head having a ratio of width to length of spindle head of 5 to 1. The spindle, which is of crucible machinery steel, is 3¼ in. in diameter with a hole 1 1/16 in. in diameter, extending entirely through it. A driving plate arranged to drive a face mill by key and bolting to the flange is provided. The spindle can be adjusted vertically above the table from 1½ to 11½ in. by hand and the dial controlling the adjustment is graduated to 0.001 in. Spur gears of press forged machinery steel are used for driving the spindle and the same arrangement is employed throughout the machine. The back gears, which have a ratio of 5.9 and 2.8 to 1, are of the sliding type.

The table is 13 in. wide with three ⅝-in. T-slots. Oil channels at the sides and each end are provided. The table has an adjustment in line with the spindle of 12 in. controlled by a dial reading to 0.001 in. Four changes of power feed, ranging from 21 to 42 in., are provided. The screw driving the table is of large diameter driven by a clutch having a double key and spline, the driving mechanism being arranged so that the direction of feed is against the driving clutch.

The feed box is a one-piece casting of the apron type. Tumbler gears are used and provide eight feed changes through two levers ranging from 0.007 to 0.202 in. per revolution of the spindle. The feed trip is of the lever type located at the center and front of the table and the engagement, disengagement or reversal of the feed is made by a single lever, a push pin being provided to prevent the direction of the table feed from being reversed before this pin is pushed in.

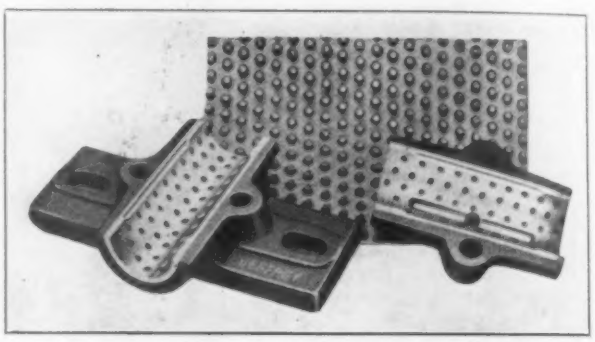
The machine illustrated is driven by a 5-hp. motor having a speed range of 300 to 1200 r.p.m., the variation being secured by manipulating the handwheel which projects at the left of the machine. This handwheel operates through a set of bevel gears to move the motor armature in or out with reference to the pole pieces and thus change the speed. A constant-speed motor can also be used in which case the changes in the spindle speed are made through gearing.



A Recently Developed Milling Machine of the Knee Type, Designed to Handle Manufacturing Work

Bearing with Graphite Sheet Lubricator

The Jeffrey Mfg. Company, Columbus, Ohio, is now equipping its standard bearings with a graphite sheet lubricator. This arrangement consists of a series of solidified cones of pure graphite which are attached by hydraulic pressure to a fine copper wire screen or fabric. In completing the bearing the wire fabric is placed in position and the babbitt metal poured in the usual way. As the metal cools it, of course, sets around the cones, making them part of the bearing, which, it is pointed out, is thus made practically self-lubricating, with the result that friction is eliminated. Among the advantages claimed for this arrangement are that the bearing will stand up under heavy pressure and high speeds without heating, thus effecting economies in babbitt metal, time and labor. The amount of oil required is materially reduced and in some cases is entirely eliminated. This reduction in the amount of oil, it is emphasized, besides effecting economies in use, also prevents the belt from becoming oil soaked from surplus lubricant, and the necessity of saturating the machinery with oil is avoided.



A Bearing in Which the Babbitt Metal Is Poured Around a Series of Graphite Cones Attached to a Fine Copper Wire Screen

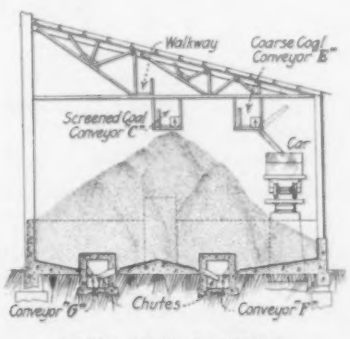
Italy's Need of Metallurgical Fuel

Owing to the coal shortage in Italy, due to reduced imports, the Associazione degli Industriali Metallurgicai Italiani has strongly emphasized the necessity of a regular supply to metallurgical and engineering works so that the interests of natural defense may be safeguarded. Three grades of coal are particularly mentioned: Steam coal, such as Cardiff and others; gas-producer coal for open-hearth furnaces, chiefly Scotch coal, splint, etc., and reheating furnace fuel, usually the splint class or New Pelton. The normal annual fuel requirements of the chief works are as follows: Blast furnaces, 800,000 tons of coke; open-hearth furnaces, 300,000 tons of coal; reheating furnaces, 40,000 tons of coal; boiler furnaces, 510,000 tons of coal; foundry cupolas, 50,000 tons of coke; foundry boilers, 50,000 tons of coke; works producing wire and other finished steel, 100,000 tons; brass, copper and lead foundries and smelting works, 30,000 tons of coal and 50,000 tons of coke; machine shops, 100,000 tons of coal.

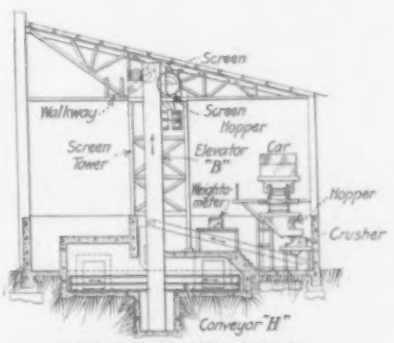
Utilizing Powdered Coal at Lebanon, Pa.

Waste-Heat Boilers Used with Open-Hearth Furnaces by American Iron & Steel Mfg. Company — Details of Pulverizing Plant

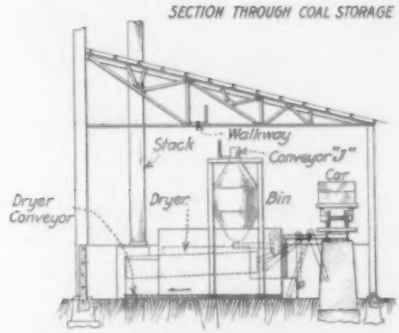
The experience with the use of powdered coal in the open-hearth furnace by the American Iron & Steel Mfg. Company, Lebanon, Pa., was discussed at length in THE IRON AGE of April 13 on the basis of a paper read before the Franklin Institute, Philadelphia, by C. J. Gadd, chief engineer of the company. This article illustrated a furnace, which is operated without regenerators, and the combination of burners of both the high and low pressure type found necessary to secure the desired temperatures and distribution of gases. The article also showed the general arrangement of the open-hearth furnaces and soaking pits of the plant and the different types of burners subjected to experiment. It discussed the engineering principles involved in the use of powdered coal in the metallurgical processes, but did not give in any detail the layout of the plant for preparing the powdered coal, nor the installa-



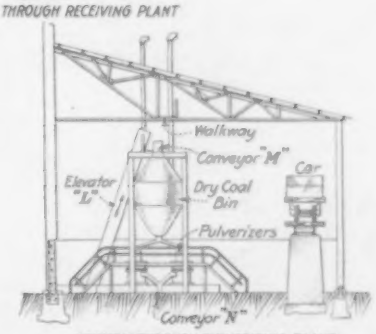
SECTION THROUGH COAL STORAGE



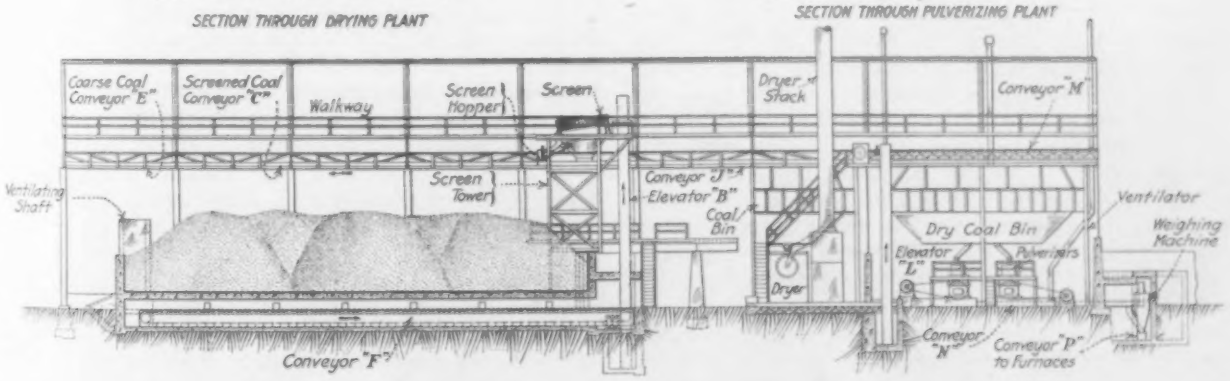
SECTION THROUGH RECEIVING PLANT



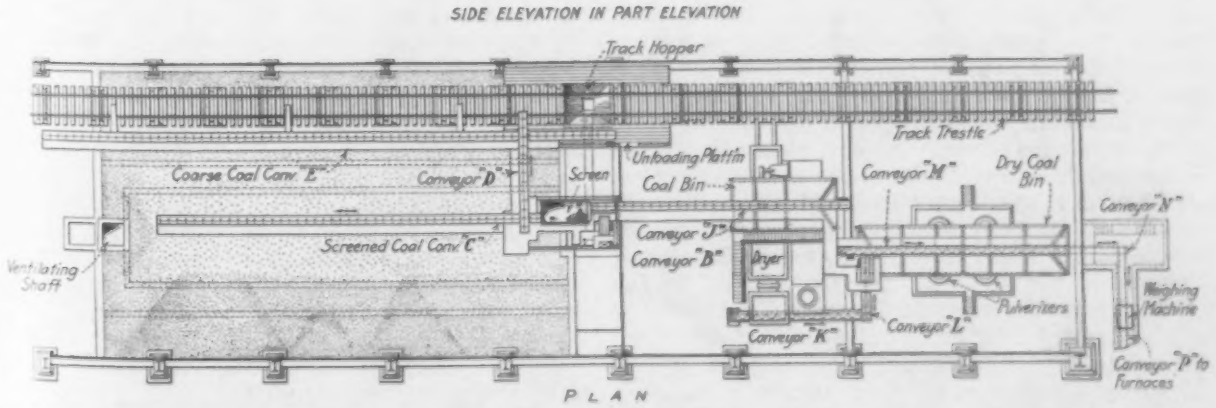
SECTION THROUGH DRYING PLANT



SECTION THROUGH PULVERIZING PLANT

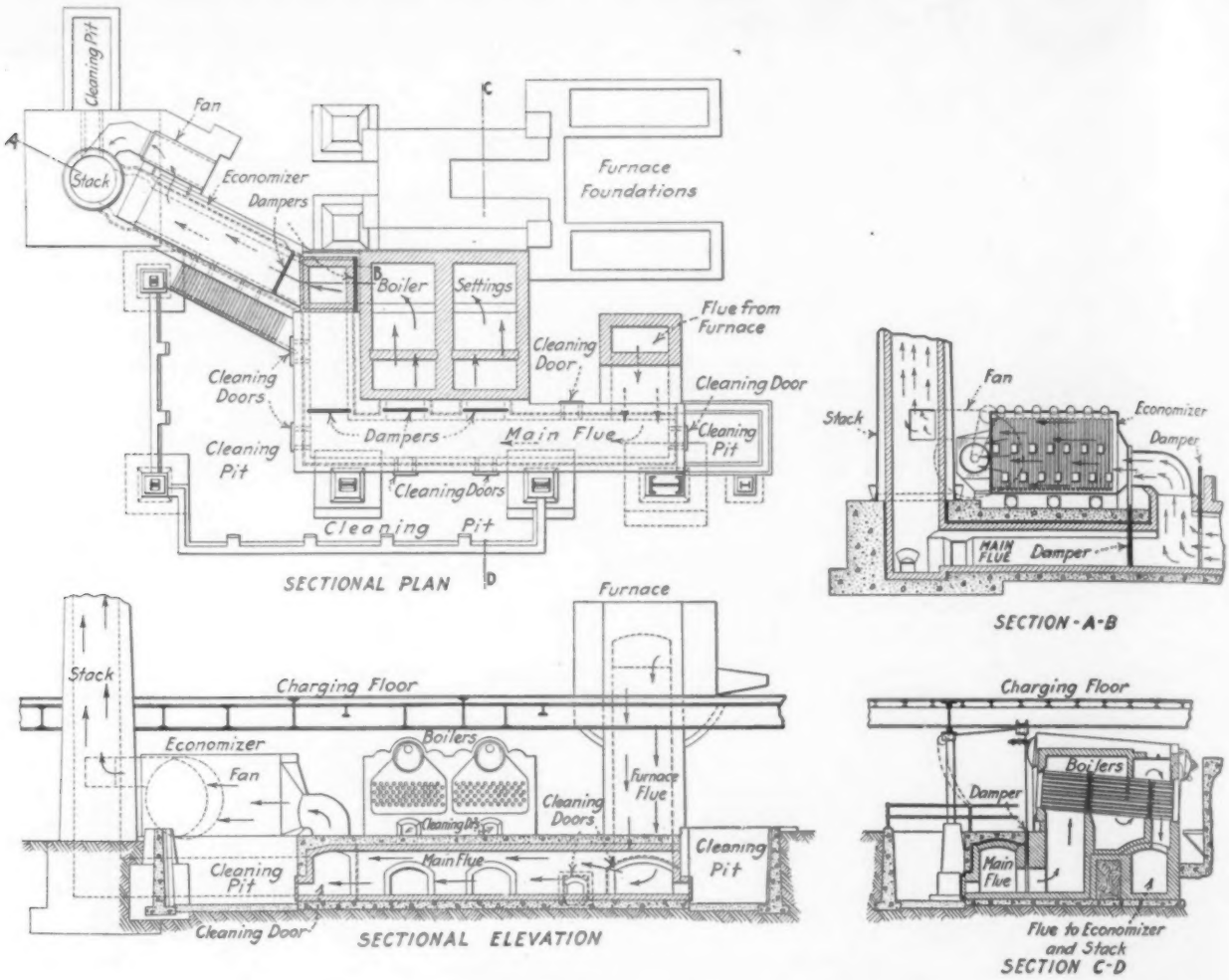


SIDE ELEVATION IN PART ELEVATION



PLAN

Besides the Coal Drying and Pulverizing Apparatus, the Coal Preparation Plant Includes a Large Storage Space for Fine Coal as Received



An Economizer as Well as Steam Boilers Utilize the Gases from the Open-Hearth Furnace

tion of waste-heat boilers provided in connection with the open-hearth furnaces. The accompanying illustrations cover these points and round out the presentation of the paper in the issue mentioned.

One of the accompanying group of drawings covers the crushing, drying and pulverizing plant, which is particularly noteworthy for the large storage space provided for small coal. The incoming coal is brought up an inclined plane to the elevated trestle and discharged from cars of the bottom dump type into the track hopper. A pusher feed located on the bottom of the track hopper controls the flow of coal to the crusher, the crushed coal falling by gravity upon a belt conveyor which discharges into the shoe of elevator *B*. The belt conveyor is fitted with a Merrick weightometer, which affords an accurate check on the tonnage received. The nature of the coal received determines the operation of the crushing rolls. In the case of slack coal, the crusher rolls are set apart and the coal falls by gravity from the pusher feed through the crusher to the belt conveyor.

The discharge from elevator *B* is so arranged that it can be either spouted direct to conveyor *J*, which feeds the coal storage bin over the dryer or to the revolving screen. All coal placed in storage is spouted from elevator *B* to the revolving screen, which sizes it to cubes of 1 in. and under, the finer coal dropping into the hopper below the screen, thence to the flight conveyor *C*, which distributes the coal in the storage. The coarser coal is discharged from the screen to the cross flight conveyor *D*, thence on to the flight conveyor *E*, from which point it is spouted to cars for use elsewhere.

Under the storage pile two concrete re-claiming tunnels are provided, each equipped with a flight conveyor. Chutes equipped with tunnel gates are spaced at proper intervals on each side of these tunnels, through which the coal from the storage pile travels by gravity on to the flight conveyor *F* or *G*, and discharges into the reversible flight conveyor *H*, which in turn discharges into elevator *B*, from which point it is elevated and spouted to conveyor *J*, distributing the fuel in the storage bin over the dryer.

A suitable feeding mechanism is located in the bottom of the coal storage bin over the dryer, which feeds the coal at a uniform rate into the upper end of a rotary dryer. The coal passes through the dryer, which removes the moisture, and is then discharged into the dust-proof screw conveyor *K*, thence into the dust-proof elevator *L*, thence to the dust-proof screw conveyor *M*, which distributes the dried coal into the dust proof storage bin over the pulverizers.

From the dust-proof dried coal storage bin, the coal travels by gravity to the feeding mechanism on the pulverizing mills. The powdered coal is discharged from the pulverizers into the dust-proof screw conveyor *N*, from which point it is conveyed to the weighing machine, which automatically registers the weight of fuel pulverized. A by-pass connecting conveyors *N* and *P* provides a cut-out for the weighing machine and adjustments and repairs can be made to this unit, without shutting down the system. The weighing machine discharges into the dust-proof screw conveyor *P* connecting with the distributing system. In the earlier article the author explained the use of ventilating shafts to allow the escape of moisture otherwise likely to collect when the powdered coal atmosphere within bins and conveyors is cooled.

The powdered coal is distributed to four 50-ton open-hearth furnaces, five double soaking pits, and

as indicated a drawing of the open-hearth installation and also one of the soaking pit arrangement were given in the issue of April 13.

The second group of the accompanying drawings covers the waste-heat boiler installation for the open-hearth furnaces. In addition to the boilers an economizer is provided, and the course of the waste gases may be followed by the arrow marks. As noted, the arrangement of flues and dampers is such that the whole waste-heat plant may be by-passed or the economizer or both boilers may be by-passed either separately or in combination. This flexibility permits adjustment or repairs to the boilers or economizer without affecting the operation of the furnace. It will be recalled that there is the usual slag pocket at the bottom of the vertical flue from the open-hearth furnace. While the material there collected forms a thick, pasty mass, beyond this point the ash settles in the flues as an impalpable powder. After each heat it is stirred up by inserting a compressed air jet through the separate cleaning doors of the flues. The ash clouds produced are picked up by the flue draft and carried in suspension out of the stack. The tubes of the waste-heat boilers are cleaned by means of steam blowers four times each day.

BRITTLE ANNEALED COPPER*

Caused by Reducing Gases Acting on Dissolved Oxygen and Not by Burning

BY W. E. RUDER

In the process of manufacture of commercial copper, it has been found advisable to leave a certain amount of oxygen in the copper in order that it may retain the very desirable properties of ductility and mechanical strength. The ease with which copper takes up oxygen during smelting makes it necessary that this oxide be removed by the process of "poling," during which the oxide is reduced by the gases given off by the green poles. This process is carried on until only the small amount of oxygen necessary to produce "tough pitch" copper remains. This oxygen exists in practically all commercial copper, not specially deoxidized, in the form of Cu_2O and forms a matrix of eutectic around the primary copper grains.

It is common practice in annealing copper to maintain a strictly neutral or slightly oxidizing atmosphere. In calorizing it was found that copper articles became quite brittle even at temperatures as low as 500 deg. C. In forging and working copper it is also necessary to have the atmosphere of the heating furnace pretty well regulated, or the whole lot will become unworkable.

Copper rail-bonds made up of strands of commercial copper wire, heated in an oil muffle during the process of manufacture, frequently and irregularly showed brittleness as though burned, but there was no sign of oxidation. It was assumed that the harmful effect was due to reducing gases from the fire which sometimes come into direct contact with the copper. To demonstrate this, an experiment was tried as follows:

Two quartz tubes were placed into a vertical electrically-heated furnace. One was closed and the other open at the lower end, while the upper ends of both tubes were open and extended outside the furnace. Commercial copper wires were placed in each of these tubes. Hydrogen gas was fed into the furnace and came into contact with the wires in the open tube, but not with the others. The result of heating to red heat for 10 minutes in this case was the apparent rotting of the wire in the tube open at both ends but not in the tube closed to the hydrogen.

Further evidence that this brittleness is due to the action of the reducing gases upon the dissolved oxygen is had from the fact that copper to which boron carbide or some other deoxidizing agent has been added does not show this effect. It is the purpose of this paper to report the result of a few experiments made to determine the effect upon regular and deoxidized copper, at different temperatures, of a few of the more common gases met with in practice.

Cuprous oxide may be reduced by hydrogen or carbon monoxide at temperatures as low as 200 deg. C. Some effect must therefore be expected, even at temperatures below those usually employed in annealing.

In these experiments wires of plain 0.15 in. (3.8 mm.) and boronized 0.125 in. (3.2 mm.) copper were used. It was soon found that smaller wires were more sensitive to exposure for a short time at the lower ranges, and so a piece of 0.05 in. (1.3 mm.) wire of each kind was also used in each run. No accurate measurements of brittleness were made, as a simple bending test was sufficient for the purpose. If a wire would not stand bending to a right angle and back without cracking, it was termed brittle. Samples were run at 100 deg. intervals from 400 deg. C. to 1000 deg. C. and held for two hours.

EFFECT OF DRY AND WET HYDROGEN

Electrolytic hydrogen, purified by running over hot copper and thoroughly dried over P_2O_5, was used.

Commercial Copper.—At 400 deg. C. no brittleness could be detected after a two hours' anneal. After 31 hours' anneal, however, a decided weakening had occurred.

At 500 deg. C. the smaller wires were quite brittle after two hours, and the large one cracked on the surface, showing that the action had started.

At 600 deg. C. the brittleness had penetrated about 3/64 in. (1.2 mm.) on the large piece, and the small wire was extremely brittle.

At 800 deg. C. the large wire became so brittle that it broke on bending through an angle of 10 deg.

At 1000 deg. C. the copper was still brittle, but showed a marked tendency toward recovery.

On remelting in hydrogen the copper was restored to its original ductility.

Deoxidized Copper.—Copper, which had been deoxodized by the addition of boron in the form of boron carbide, and run through the same treatment as the regular copper samples above, in no case exhibited the least trace of brittleness.

Hydrogen bubbled through water had the same effect as the purified hydrogen, except that the brittleness did not appear until a temperature of 600 deg. C. was reached. Deoxidized copper was not affected at any temerature.

EFFECT OF CARBON MONOXIDE AND DIOXIDE

Brittleness was not observed in this treatment until a temperature of about 850 to 900 deg. C. was attained. At 900 and 1000 deg. C., however, extreme brittleness was caused in two hours. As in previous cases, boronized copper was unaffected. The high temperature needed to produce brittleness in this case was probably due to the presence of considerable CO_2 mixed with the CO. The CO gas was made by passing a slow stream of air over incandescent charcoal. The samples were all somewhat oxidized on the surface.

Tank CO_2 dried over sulphuric acid was used in these experiments. The samples scaled quite severely at the higher temperatures, but no perceptible brittleness occurred in any of the samples except the boronized copper run at 900 and 1000 deg. C. This result was rather unexpected, and the reason why this deoxidized copper should be more brittle than the regular copper under these particular circumstances is not yet clear, as oxidization should have made each one brittle.

EFFECT OF STEAM

A slight brittleness was observed in regular copper at 700 deg. C. This increased with the temperature, but in no case was the material as brittle as that treated in hydrogen or CO gas. An explosion of the hydrogen gas occurred at the mouth of the furnace running at 1000 deg. C.

SUMMARY

It has been shown that the brittleness of copper developed during heating in the process of manufacture and frequently ascribed to "burning," is in reality a deoxidation. With ordinary commercial copper, serious brittleness begins to appear at 400 deg. C. in dry hydrogen, at 600 deg. C. in wet hydrogen, at about 800 to 850 deg. C. in CO, and at 700 deg. C. in steam. Copper which had previously been deoxidized by the addition of boron remains unaffected at all temperatures in a reducing atmosphere.

*From a paper presented at the annual convention of the American Electrochemical Society at Washington, April 27, 1916. The author is in the research department of the General Electric Company, Schenectady, N. Y.

World Questions and Co-operation at

The American Iron and Steel Institute Hears Addresses—Federal Trade Commissioner

The high mark in attendance was reached at the tenth general meeting of the American Iron and Steel Institute, held at the Waldorf-Astoria, New York, on Friday, May 26. More than 750 members and guests were present at the banquet and nearly that number attended the morning and afternoon sessions. President Gary committed himself forcefully on a number of national issues in his opening address. He touched on preparedness, on merchant marine and the necessity of an adequate protective tariff. Concerning the tariff he said that "the doctrine of America first, which is a patriotic one, applies with peculiar force to the idea of sufficient protection to American industries. This means," he added, "not a prohibitive tariff but one large enough to permit continued success in competition with the outside world."

The technical papers of the day were of a high order. However, in view of the dominating place of world questions in all current discussion, technical matters were over-shadowed at the meeting by the considerations presented by Judge Gary and by Vice-chairman Hurley of the Federal Trade Commission. Mr. Hurley was the chief guest at the dinner on Friday evening. He came out strongly for co-operation between business interests and between the Government and business, and his remarks were interpreted as an earnest of the Federal Trade Commission's attitude toward business—an attitude of friendly co-operation rather than antagonism.

For the first time in the Institute's history the grand ball room of the Waldorf-Astoria was the meeting place. So many members came that the Astor Gallery with which all the Gary dinners are associated, was inadequate. Fully 700 were in attendance as the reading of the president's address began. Preliminary to his address President Gary said that steel men to-day have many causes for congratulation. It has become fashionable to be a steel maker and very little criticism is heard concerning steel men or their industry. The time is ripe to say some things which if said earlier might have fallen on barren soil.

Presidential Address

At the outset Judge Gary referred to his address as an effort to interpret public sentiment in the United States on several matters related to business. A cardinal point in sentiment now being made on the great questions confronting American people is the belief that "we should first protect and advance the interests of our own citizens of all classes, nationalities and conditions and then assist our neighbors across the seas, wherever they may be, as our means and liberality may permit." The speaker said that it is high time for every one to understand that a large majority of the people of the United States are going to insist upon the utilization of every facility to protect and honorably to further the interests of their own country. Emphasis was laid upon the obligation of business men, particularly those connected with large interests, to manage their affairs in accordance with public opinion, the laws of the land and the principles of right and justice. "I commend you all for what you have stood for and accomplished in this respect and I adjure you to be steadfast and persistent to the end in your endeavor to maintain the reputation you have established."

> **The thoughts of the multitudes are looking forward to the time and opportunity for the firm establishment of a basis for permanent peace, a condition which will prevent prolonged international conflict. Our country would, if possible, exert an influence in this direction, and it may be practicable if we avoid unnecessary controversy, if we are reasonable and patient and constantly give evidence of a Christian spirit. We may be considerate and conciliatory without yielding our honor or lowering our self-respect. It is no stultification to offer the olive branch even if insulted.**—*Judge Gary's Address.*

PROTECTION

The section of the address referring to protective laws is given below substantially in full:

In connection with the conservation of our wealth and prosperity there must be considered the question of adequate and proper legal protection to American industries. We are a nation of producers as distinguished from a nation of consumers. Our national resources and conditions place us in this position and give us this advantage. The producers include the owners whose interests are represented by stocks in corporations or otherwise and by those who as employees perform the larger portion of the manual labor. Many of the latter are holders of corporate stock but the large majority are not. However, all are interested exactly alike. Together they are in normal times in competition, severe even though good natured, with the producers of other countries. As to many products, some of the other countries can produce at a lower cost than we can produce, based on the past and present scale of wages for labor. The labor of this country is thus brought into direct competition with the labor of other countries. It is well known that wages in the leading foreign countries have been about one-half the amount paid here for similar services and that in some countries, such as China, they are many times lower.

Many foreigners have heretofore been in competition with us in selling to non-producing countries and they have also dumped their surplus stocks in this country in times of depression at prices even below our costs and sometimes below their own. The articles sold in competition with us include large numbers of manufactured

Home Uppermost at the Steel Meeting

Four Technical Papers and Two Notable Hurley Strongly Favors Co-operative Effort

products and also raw products, such as wool, cotton, fruits, etc. Many of you have seen lemons by the millions, grown in California, going to waste because imported lemons are selling here at prices less than the cost of picking, boxing and shipping. Most of the foreign producing countries have in force tariff laws that fully protect their industries; and probably all will hereafter have similar laws; such are the indications as published in the daily press. Besides many of the governments furnish aid to their industries in many ways not necessary to mention at this time. After the war is over the contending nations will be impoverished and in great need of business and money. They will produce as much as possible and their facilities are generally unimpaired. They will sell wherever they can find a market and at low prices if necessary, including this country, if we are not protected against them, and we cannot sell in their countries because they are and will be protected against us.

Depression Before the War

We have for many months last past been secure by reason of the well-known conditions of war, but if we carry our minds back to the circumstances existing shortly prior to the war we know what we may expect after the close, unless there is a change in our laws. From the time the present tariff laws came into force, in October, 1913, until some time after the war was started the effect upon our business was very bad. It was almost desperate with many. The prices of imported products dumped into our markets, though not large in volume as to some items, were so low that we were compelled to put our prices down to about cost and, in instances, below. Many were operating at a loss. We were going from bad to worse. Except for the war and war orders, wages would necessarily have been materially reduced and even then many employers would have been compelled to suspend. We know by sad experience that unless our tariff laws are changed so as to protect our business and place us on a parity with our foreign competitors, the large majority of producers will suffer, that business will be depressed, that the number of idle mills and cars and men will be increased and that wages will be lowered. We have seen these conditions before and there is reason to fear that they may be worse than ever unless our tariff laws are improved.

Nature of the Tariff Needed

It may be observed by way of diversion (for general public sentiment may not have become focused on the subject) that it is not of first importance to consider the forms of details to be adopted. There should be included in the laws features which will furnish reasonable and adequate protection to American industries and also the necessary revenue for Government purposes; a plan for reciprocity or reciprocal negotiations and relations with other countries so that all conditions, changes and emergencies can be met and solved for the benefit of all concerned; and the amounts of tariffs applicable to various commodities should be carefully, logically and scientifically ascertained, and necessary, fair and reasonable protection—no more and no less—would thus be afforded. If these amounts are to be reported upon by a commission, competent and disinterested, the report should be made to the Ways and Means Committee for consideration and report to the House of Representatives. The party in power perhaps ought to have the right of final decision, especially as long as the tariff is made a party issue and submitted to the vote of the people at large. By the method suggested it seems probable there would be removed the struggle between different localities to secure advantages for one place or one industry over another, which has heretofore resulted in unsatisfactory rates, in some cases.

The principle of protection to industry by means of tariff laws has built up the commerce and the wealth of this country and other producing countries that have had a surplus for export. Its value has been demonstrated. As between nations, it is simply a safe, sound, business proposition. So long as one country maintains it, others similarly circumstanced must do likewise in order to protect the interests of the large majority, including particularly the great aggregate of workmen. A benefit to the majority in the end advances the interests of even the minority, so closely connected and interdependent are the interests of each.

Only a Phase of "America First"

When our competitors in other leading countries are ready to adopt the laws of free trade for our commodities it will be soon enough for us to favorably consider similar action. If we were to have free trade throughout the world, we could probably take care of ourselves in any contest for the disposal of what we have for sale. In view of conditions as they exist in normal times, it is not logical to place or to leave the United States in a position of disadvantage when we have the opportunity to establish a parity. The doctrine of America first, which is a patriotic one, applies with peculiar force to the idea of sufficient protection to American industries. This means not a prohibitive tariff, but one large enough to permit continued success in competition with the outside world.

MERCHANT MARINE

On the question of the merchant marine, Judge Gary said that one reason for the limited amount of our export business in the past was the lack of ships owned and operated by Americans. Foreign laws aid foreign owned and operated ships and domestic laws add to the burdens and costs of the operation of our own ships. Laws should be adopted that would place our merchant marine practically on an equality with those of other nations. The subject has received more attention in the last two years than for decades before and we may hope to see some existing laws repealed and other necessary and proper laws enacted.

Referring to the desire for peace so plainly evident in this country, the speaker said that the

> **The United States must be ready to support other nations in insisting that the ports of all foreign friendly nations remain free and open to all. And even more important, we would be able to exert a powerful influence in aiding and even compelling international peace. If there shall be effected a basis for the settlement by arbitration of all international disputes and the enforcement of the decrees entered by a competent, disinterested court, then the permanency of this court, as well as its creation, will depend largely upon the strength of this, the leading country, from a military as well as from a financial standpoint.**—*Judge Gary's Address.*

American people do not wish for war and do not believe it necessary to engage in it with any European nation. Moreover, if it should be necessary to engage in conflict with any of the principal European countries we are unprepared to fight, even in self-defense. The large majority of our people are determined we shall not become involved in serious trouble with any European country. Of Japan, Judge Gary said:

It is neither desirable nor necessary to have any serious controversy with Japan. We wish for nothing they possess and we believe they seek nothing that belongs to us. We would not oppose any legitimate effort on their part to progress in competition with us and the same disposition may be expected of them. They have shown wonderful capacity and skill in developing their resources and in expanding their commercial interests and we admire them for it. We have no feeling of envy or covetousness and the same is true of them.

PREPAREDNESS

On the desirability and cost of preparation for defense the speaker said in part:

The cost of providing and maintaining a sufficient army and navy will be large, but small in comparison with the cost of war if one should be forced upon us because of a state of unpreparedness. When we read that the money expended for war purposes by a single European belligernt nation amounts to $25,000,000 per day, it is seen that any estimate of the cost of military preparation and maintenance is insignificant in comparison. As a mere matter of economy it is quite probable there would be saved billions of dollars by expending hundreds of thousands for military purposes. Withholding appropriations needed for purposes of preparing and keeping prepared for defense would be a false economy. It would be comparable to a refusal to make the necessary outlay for a good and sufficient lock to the doors of a house containing valuables and located in a burglar infested district, or one that might be so infested by reason of the fact that protection was insufficient. Besides, if the United States is to assume and maintain the important position among nations that has been thrust upon her, she must be possessed of the same elements of power and strength that others have. She must be prepared to protect her commerce on the seas, which, let us hope, may equal that of any other single country.

MILLS BOOKED WELL INTO 1917

In concluding Judge Gary discussed business conditions in these terms:

The steel industry is good; better than ever before. There have recently been publications to the effect that there is a falling off in new orders and this may be true to a slight extent, but the daily bookings generally are larger in volume than the total producing capacity, and as the unfinished orders on hand are sufficient to keep the mills busy for the remainder of this calendar year and a large portion of 1917 there is not much, if any, cause for concern on the part of manufacturers for the next twelve months at least. We could wish that we had been permitted to continue co-operation on a basis that would have influenced greater stability in prices, higher in times of depression and lower in times of great activity, for it would have been satisfactory and beneficial to both producer and consumer and to their employees; but circumstances, over which we had no control, brought about a change in this particular. Public sentiment may bring about a restoration of the former and better methods. Who can tell? We know, at least, that conditions in our industry are infinitely better than they were fifteen years ago or more. Whatever happens we may continue to entertain the same feeling of respect and esteem for each other that has characterized our intercourse these many years.

Papers and Discussions

The program of papers was shorter than usual—a good innovation. Some of the writers might have gone farther in improving on what has been the rule at other meetings, and instead of reading at length from their papers, have presented a well digested synopsis.

William H. Childs, president Barrett Company, New York, presented an excellent paper at the morning session—a thoroughgoing summary of the "By-Products Recovered in the Manufacture of Coke." It was well illustrated. Only one member discussed it, but he was highly competent to do so—W. H. Blauvelt of the Semet-Solvay Company, Syracuse, N. Y.

"The Electric Furnace in Steel Manufacture," an admirable paper by Dr. John A. Mathews, president Halcomb Steel Company, Syracuse, N. Y., is given in full elsewhere, together with several contributions to its discussion.

Rails and Rail Service

An interesting feature of the afternoon session was the discussion on "Rail Manufacture" presented by H. C. Ryding, assistant to vice-president and general manager, Tennessee Coal, Iron & Railroad Company. Mr. Ryding said:

The paper informs you that the rail industry ranks third in tonnage among steel products and that only 12 per cent of the steel produced is put into rails. If it were possible it would be very interesting to know what proportion of the total work done by all the steel produced is borne by this small proportion of 12 per cent going into rails. Whatever it is, it is very large; it is still increasing, and at such a rate, by reason of heavier loads and more of them, together with greater speeds, that both the manufacturers and the railroads have devoted themselves earnestly to the task of improving the quality and section of rails to meet this growth of more severe conditions of service.

The railroads for economic reasons have within recent years doubled the loading capacity of cars, and it is very natural, since the carrying capacity of railroad tracks has not also been doubled, that weaknesses in certain parts of the track should develop. The rail as a part of the track, therefore, has become a problem and manufacturers are interested not only in their process of producing rails but are also vitally interested in conditions surrounding the rails made by them, when put into the track.

RESPONSIBILITY OF RAILROADS

To get the best results the railroads must give as much attention and care to track conditions as the manufacturer now gives to every process through which the material passes up to the finished rail. It is not only true that the manufacturers are giving decidedly more attention to and exercising more care in every process through which the rail passes, but it is also true that the railroads are diligently at work in caring for and improving track conditions, all of which are showing a gratifying reduction in the number of accidents occurring and of rails failing in service.

At the works with which I am connected we have co-operated with the American Railway Engineering Association's representative in making some very interesting investigations in the process of blooming the steel, results of which have all been published.

The rail manufacturers in this country to-day are working to a very large number of rail specifications, some varying radically from others in certain respects, but generally the differences are not so great as to make it impossible to frame a common specification, acceptable to both the railroads and the manufacturers. This should be done and would to a great extent provide a common ground on which to devise still further ways and means for rail betterment.

With increasing loads there has been a growing

tendency to use heavier sections of rails, but the adoption of heavier rail sections has not been as rapid as the development of the heavier equipment.

Rails are now being rolled up to 130 lb. per yard, but they have not been in use sufficiently long to obtain reliable data as to their wearing qualities compared with lighter sections used under the same conditions of traffic. This gradual increase in the weight of rails has been productive of a great number of rail sections being used and from time to time efforts have been made to standardize series of rail sections such as was done by the American Society of Civil Engineers and the American Railway Association. In addition to the above well-known rails, a great many railroads have designed and used for many years sections of their own, thus increasing the number of sections of rails to the point where it seems well nigh impossible to decide upon a standard type of rail.

CHANGES NEEDED IN THE FORM OF RAIL

The form of the rail is an important consideration. I have for some time felt that the heads have been too wide. So much so that in some instances where the wheels have worn to fit a rail having a narrow head, these same wheels running over rails with wider heads, bear only on the false flanges on the outer sides of the heads of these rails. To illustrate, take the 100-lb. A. S. C. E. rail. The width across the top of the head is 2¾ in. The effect of this width, in conjunction with the usual beveled tread of the wheels, is to throw the entire load on the top inside corner of the head, and until this part of the rail wears down the load continues to be carried to one side of the head, and is therefore not carried centrally on the rail.

In the case of a new 90-lb. A. R. A. type A rail, with the treads of the wheels beveled 1 in 24, the nearest point of contact of the wheel on the rail is 7/10 in. away from the center of the head. In structural work, the load is always carried centrally on a girder. If the load were carried to one side, as in the case of rails, the girder would have to be made materially stronger. What is true of a structural girder is true of a rail which is also a girder. A modification, therefore, in the shape of the heads of rails as made to-day can, I think, be made to serve a very useful purpose. In the case of the 100-lb. A. S. C. E. rail, the present width of the head can be maintained at the bottom so as not to decrease the fish-plate bearing. The sides of heads can be made to incline inwardly 7½ deg., making the width across the top of the head 9/32 in. less than at present, and the metal displaced from the sides added to the top of the head, increasing its depth 7/64 or nearly ⅛ of an inch and the total height of the rail an equal amount.

The effect of such changes will be to strengthen the rail as a girder, stiffen the head, more nearly centralize the load on the rail and will not increase its weight. In the case of the 100-lb. A. R. A. type B rail, the same changes would increase the depth of the head 3/32 in. and the height of the rail an equal amount.

INCREASE IN WEIGHT

In addition to changes in the form of the rail, the weight per yard will also have to be increased and to what extent this should be done will depend entirely upon the conclusion to be reached by the work of investigation now being done by the railroads and the manufacturers.

The railroads are demanding a steel rail more uniform in physical qualities. Steel showing any evidence of piping or segregation is not considered suitable for the purpose. The manufacturers are studying ways and means of reducing these objectionable features to a minimum and decided progress is being made.

Other causes of failure, such as transverse fissures, are receiving very careful study. This particular cause of rail failure has received the attention of the rail manufacturers and metallurgists for the past two years, and still to-day we are without a satisfactory explanation of the causes producing them. Changes in the present methods of making rails will, as heretofore, suggest themselves.

The rail will undoubtedly be improved. On account of the very great importance of the work required of rails, these changes will come slowly, but none the less surely.

An interesting section of the day's program was that of the late afternoon. George W. Vreeland, superintendent of blast furnaces at the Mingo Junction, Ohio, plant of the Carnegie Steel Company, submitted a carefully prepared paper on "The Distribution of Materials in the Blast Furnace." It is fully abstracted elsewhere in this issue.

October Meeting at St. Louis

The directors at their meeting at the noon intermission decided the important question of the place of the October meeting. Detroit, Buffalo and St. Louis had presented invitations. On behalf of St. Louis some very energetic and successful work was done by Clarence H. Howard, president of the Commonwealth Steel Company. Mr. Howard is president of the Business Men's League and the invitation came from that organization. By a unanimous vote it was accepted. The directors also acted on a number of applications for membership and the following were elected:

George Endicott, mechanical and metallurgical engineer Morgan Spring Company, Worcester, Mass.

Walter C. Swart, mining engineer, Duluth.

Thomas Towns, director and general manager Swedish Iron & Steel Corporation, New York.

William H. Murphy, operator in ore lands and manufacturer, Detroit.

Cassius F. Biggert, vice-president Wisconsin Steel Company, Chicago.

Edward Caterson, sales manager Youngstown Iron & Steel Company, New York.

Edward V. Peters, assistant general manager New Jersey Zinc Company, New York.

Nelson Price Whitaker, secretary Whitaker-Glessner Company, Wheeling, W. Va.

James C. Griffin, Griffin Mfg. Company, Erie, Pa.

Frank S. Bigler, vice-president and general manager Michigan Bolt & Nut Works, Detroit.

Daniel M. Rugg, coke oven engineer Gas Machinery Company, Cleveland.

Walter S. Russell, president Russell Wheel & Foundry Company, Detroit.

John A. Allen, purchasing agent Brier Hill Steel Company, Youngstown.

Alan D. Wood, purchasing agent Alan Wood Iron & Steel Company, Philadelphia.

Malcolm Wallace Leech, district sales manager West Leechburg Steel Company, New York.

Alfred C. Howell, steel department W. Bingham Company, Cleveland.

Phillip H. McMillan, capitalist, Detroit.

George W. Piffer, general superintendent open hearth department Republic Iron & Steel Company, Youngstown, Ohio.

Banquet Program

The dinner attendance was the largest in the Institute's history. The program began about 9.30 and concluded shortly before 1 a. m. Saturday. Judge Gary introduced Hon. Edward N. Hurley, vice-chairman of the Federal Trade Commission, as the first speaker of the evening. Much of Mr. Hurley's address appears on other pages. The chairman referred to Mr. Hurley as a conservative and constructive force, ready and anxious to assist business men in carrying on their affairs to the fullest success. The speaker was received warmly and the warmth of the greeting was redoubled as he took his seat. Judge Gary electrified his audience by questioning, as Mr. Hurley sat down, whether what they had just heard was all a dream. To have listened to such expressions from a competent and experienced business man and a real statesman made it easily possible, he said, to imagine that one was at a "Gary dinner," a remark which raised an appreciative wave of laughter.

WHY NOT CO-OPERATION AT HOME?

Speaking with much earnestness, Judge Gary

called his hearers to witness that much of what had beeen outlined in Mr. Hurley's address was identical with the aims of steel manufacturers in their movement which began after the panic of 1907. There never was a Gary dinner, he said, without the sending of a statement of substantially all that took place to the Department of Justice at Washington. Pointedly the chairman then raised the question if co-operation is a good thing for the export business why is it not a good principle to apply to business at home? His hearers were quick to applaud. He spoke of Mr. Hurley as representing the sentiment of the people of the country. Steel manufacturers should never forget that they are a part of the people of the United States and have definite obligations of loyalty to the sentiments of the whole people as well as to the laws of the country.

HOW HELL GATE BRIDGE WAS BUILT

A capital feature of the banquet program was the story of the building of the Hell Gate bridge as told by Jacob Loewenstein, engineer of the American Bridge Company. This bridge, as is well known, is the most interesting piece of engineering work in the New York Connecting Railroad. It is a four-track structure having a span length of 977 ft. 6 in., a clear height of 135 ft. above mean high water and an extreme height of 307 ft. 6 in. above mean high water. Mr. Loewenstein emphasized the noteworthy factors in what he called the "boldest erection scheme on record." These were the placing in the permanent structure of about 85 per cent of the entire temporary erection material; exclusive use of steel for all temporary supports; the use of working cages for safeguarding the men; the accuracy with which the entire back anchorage and arch were fabricated and erected. The steel manufacturers were asked to consider the new field of bridge construction that could be opened by rolling larger pieces of material. The 8 x 8 in. angles used were the largest size obtainable but better results could have been reached by using 10 x 10 or 12 x 12 in.

Mr. Loewenstein told his story with admirable clearnesss and supplemented his still views by moving pictures. These latter were a striking addition to the description, introducing the unique feature of building the bridge in four or five minutes. By speeding up the motion pictures, the lifting of each member into place and every operation of the traveler were performed with a realism at which the onlookers broke out into hearty applause.

UNITED ENGINEERING SOCIETY'S WORK

The "impromptu" part of the after-dinner speechmaking had a special relish in the fact that a new set of speakers was brought to the front. Charles F. Rand was called out first and gave some idea of the work of the United Engineering Society, laying particular stress on its library and the important contribution it is prepared to make to the research work of any of the iron and steel companies that might make use of its resources.

Charles C. Cluff, New York sales manager of the Carnegie Steel Company, followed with some observations on the lot of the steel salesman in the present condition of the market. The salesman stands between the buyer, who is pressing for deliveries, and the mill, which is unable to make them satisfactorily to any one—an envoy extraordinary charged to execute certain negotiations to the advantage of both customer and mill. He must so discharge this duty that the result will not militate against his company to the extent of losing the customer's business, for the time will surely come when such business will be particularly needed. One of the bright spots in the sales manager's life is the satisfaction he is getting from obtaining for his company the top prices afforded by the market and at the same time so taking care of his customer that the satisfaction is mutual.

JAMES GAYLEY ON PREPARATION FOR COMPETITION

James Gayley evoked emphatic applause by what he said on preparedness for competition. He referred to the enormous debts under which European countries would stagger long years following the war. One of the heaviest losses Germany would find he considered to be the waking up that had come to her enemies and other nations through the demonstration of efficiency she had made in every move connected with the war. Inevitably the stimulus Germany's great performance in arms and industry has given to effective effort in other countries would result in more intense competition for her after the war than she had ever encountered. The United States has been lulled into a sense of security by its isolation; but it may come about that the profound stirring of the older nations by war may make them in the end younger nations, and the danger is that this young nation of ours may find itself in the role of an older nation. Going into detail as to means of preparation, Mr. Gayley emphasized the endowment of institutions for technical education and of research work for the economizing of materials; the establishment of schools of commerce; making physical and military training compulsory in our schools. This compulsory training should not aim at preparation for defense alone, but it should be regarded as a highly educational measure and means of telling young men that their education is to be thought of as in part for the nation and not all for themselves, as it has been the custom to think, and to emphasize the necessity of physical fitness for the duties of life.

Late as the hour was, the diners gave excellent attention to each of the remaining speakers as they were called to the front. W. S. Pilling paid a tribute to the way in which the big men of the large corporations had borne themselves in the Institute movement in their relations with representatives of smaller concerns. In the beginning he had some misgivings, but as he watched the development of the movement he had only praise for the way in which the rights and interests of all have been regarded by the representatives of the great corporations. Excellent remarks were made by J. V. W. Reynders, who recently retired from the management of Pennsylvania Steel Company interests at Steelton, Pa. Following him Robert J. Mercur of Montreal was called upon, and then came George P. Early of the American Sheet & Tin Plate Company, who stirred his auditors with his apt putting of things, referring to Judge Gary as a great optimist and to Charles M. Schwab as the inventor of optimism. The audience was glad to get a look at Clarence H. Howard, head of the Commonwealth Steel Company and president of the Business Men's League of St. Louis, and quite as glad to hear him give a word of welcome to St. Louis, for it had become generally noised about that Mr. Howard was the man who had captured the Institute's fall meeting of 1916 for his home city. When Judge Gary, a good distance after midnight, asked the pleasure of the diners they made known very promptly that Charles M. Schwab and James A. Farrell should be heard from. Mr. Schwab made a characteristic response and Mr. Farrell took about two minutes to give a final word. Coming into the hall he had

heard a member ask another, "Has the boom been arrested?" The reply came quickly, "Perhaps so, but it won't come to trial until next year." With such a prognosis Mr. Farrell seemed to agree and his auditors were not slow to show that they were with him.

Co-operation for Developing Foreign Trade

In opening his address before the American Iron and Steel Institute at the Waldorf-Astoria Friday evening, May 26, Edward N. Hurley, vice-chairman of the Federal Trade Commission, said: "Your Institute has already done much to put in practice the principles which I believe lie at the foundation of all successful business, and, being the greatest association in the greatest industry in the world, it has an importance not confined merely to its members and to the iron and steel trade, but its influence affects vitally our national life and international commerce." He then took up the forms of co-operation as practised by the steel manufacturers of Europe.

EUROPEAN CO-OPERATION IN THE IRON TRADE

We can learn many things in this country which will assist us in developing foreign trade from the organization and efficiency of the iron and steel industry in the great industrial countries of Europe. In Europe this industry illustrates the effectiveness of co-operation, first between business men, second between business men and government. I feel that we should study its methods, both because it is one of our most formidable competitors in foreign markets and because it will suggest to us methods for meeting this competition successfully.

In Italy

Only within comparatively recent years and since the introduction of foreign capital has industrial organization in the form of cartels and syndicates developed in Italy. Among the better organized industries is that of iron steel. In April, 1911, the six leading Italian iron and steel manufacturers combined and formed a syndicate known as Ferro et Accialo (Iron and Steel). The syndicate agreement was made for 12 years and the Ilva company, located at Genoa, was named to act as the common selling agency until Dec. 31, 1922. The companies in this syndicate represented a total capital of $26,800,000.

In France

The French iron and steel industry is one of the most highly organized industries in France. Of the various syndicates of iron and steel producers in France the Comptoir de Longwy is the largest and best organized. It combines 18 important firms. In 1909 its syndicate contract was extended for 20 years. Each month it fixes the prices of coke and pig iron. It produces about seven-tenths of the annual production of pig iron in France. In the interests of foreign trade it has established a special export organization which handles exclusively all the export business of its members.

In Belgium

Nearly all of the leading Belgian industries are exporting industries and long ago pooled their forces and combined for the purpose of promoting their export trade. The steel manufacturers have a syndicate which is organized along the same line as the steel syndicate of Germany with which it has an agreement concerning Class "A" products. It sells its products exclusively through a common selling agency located at Brussels. About three-fourths of its products are exported. In practically every branch of the Belgian iron and steel industry there are smaller cartels and syndicates through which the manufacturers work jointly for their common interest. It is said that the success of Belgian export trade is in a large measure due to organization and co-operation among industrial producers.

In Great Britain

A well-known English economist in a recent discussion of organization and combinations among British iron and steel producers said: "In all the recent amalgamations *the main desire has been to increase the power of resisting American competition*, and the opportunity has been taken of raising fresh capital from the public for the purpose of extending works and modernizing plants."

Although there is a tendency among British iron and steel manufacturers toward merging small with large concerns (as in the case of Bolckow, Vaughan & Co.; Gest, Keen & Nettlefolds; Vickers Sons & Maxim; Sir W. Armstrong, and Whitworth & Co.), numerous combinations and trade associations also exist for controlling prices and production and combating foreign competition.

Among the larger combinations of steel producers are the Scotch Steel Makers' Associatin and the North of England makers. Both of these divide territory and fix prices. Other similar organizations are the National Galvanized Steel Makers' Association, the tin plate bar combine, the South Wales Siemens Steel Makers' Association. The manufacturers of galvanized sheets, which constitute one of the chief items of English steel exports, are also organized. As illustrative of the extent to which the British iron and steel trade has been syndicated I may mention the fact that the greater part of the annual output of ship and boiler plates, galvanized sheets, tin plate bars and rails, amounting to 3,000,000 to 3,500,000 tons, is controlled by combinations of manufacturers.

In Germany

The German steel industry has few if any equals in effective organization. It offers a typical example of how efficient industrial organization and co-operation, assisted by government, may succeed in building up a large national industry shipping its products to all parts of the world. The German Steel Syndicate (Stahlwerks Verband) comprises 31 leading steel concerns, including the well-known Krupp company. It controls about 90 per cent of Germany's total steel production. In 1913 its production amounted to 6,339,000 tons.

The control or common selling agency of the syndicate is located in Düsseldorf. In connection with it a special clearing house for the export trade is maintained. In order to promote and regulate systematically the export trade and to equalize some disadvantages under which the German export industry is said to be placed, the syndicate, through the Düsseldorf office, computes, regulates and pays export bounties which have averaged from 10 to 15 marks per ton of steel half-products during the past 10 years. In this way it expended from 1904 to 1908 a total of 17 million marks.

ADVANTAGES OF SYNDICATES

Business men, economists and statesmen of the leading commercial nations of Europe practically agree that where industries are efficiently managed and under proper governmental regulation, the cartel and syndicate have proven their desirability from an economic point of view and have enabled those nations to hold a dominant position in the world's markets. German and French writers point with pride to the success achieved by their respective iron and steel syndicates, and the present German Minister of Finance, Dr. Helfferich, stated a short while ago that the cartel organization has been the acme of German industrial enterprise during the past 25 years.

European iron and steel producers have repeatedly called attention to the fact that their system of co-operation has enabled them to prevent *or at least tide*

over periods of business depression and industrial crisis.

Official government investigations in several European countries make it clear that cartels have succeeded in reducing both the cost of production and the selling expenses, which permits the consumer to purchase the finished product at a lower figure. In the case of the French Comptoir de Longwy co-operation in selling has reduced selling expenses to 3 or 4 cents per ton. It is maintained that the cartel organization also enables manufacturers to equalize supply and demand, to adapt their prices to demand, and to regulate the prices of their products in accordance with the cost of raw materials.

AMERICAN SUPREMACY

In a report to the Chamberlain Tariff Commission of England, J. Stephan Jeans, secretary of the British Iron Trade Association, said: "All other things being approximately equal, the country that produces the cheapest pig iron should in the long run be the master of the iron trade situation." It is my belief that if the cost sheets of the iron and steel industries in the countries which have been mentioned were compared with those of the United States, the comparison would show that pig iron is produced in this country as cheap as in any country of the world. I believe that not merely in natural resources but in management and organization the America iron and steel industry is in a position to meet the severest competition of its foreign competitors, and in the end to conquer the iron and steel markets of the world.

GOVERNMENT AND BUSINESS

Has our Government done its part? Has it assisted and encouraged business in a consistent and constructive way? If we are to succeed in the markets of the world, it must do as other governments have been doing for many years. I doubt whether the European iron and steel industries could have achieved success in foreign markets without the active assistance of their governments. When compared with the attitude of these governments and, of late, of the Japanese government, the attitude of the American Government toward our industries presents a striking contrast.

Unfortunately, our business men and our Government have been losing valuable time during the past 15 years in trying to settle our economic and business problems, not by co-operation, not by any scientific method which will bring about results beneficial to our people as a whole, but by resorting to the courts. I know business has been sick, and business has undoubtedly been in a large measure to blame for its illness, but instead of sending for a doctor who could prescribe a remedy that would give practical and permanent relief, the Government sent for lawyers, and you know the result.

A wrong feeling has existed in this country as to the proper relations between Government and business. Even when I went to Washington I had the feeling that business men did not want to co-operate with the Government, but I learned very quickly that they are all eager to co-operate and willing to do everything in their power that the Government desires. It is now the duty of the Government to lend its active constructive aid, and it is the earnest desire of the Federal Trade Commission to do everything in its power to help foster American industries.

FEDERAL TRADE COMMISSION PLANS

The Federal Trade Commission is endeavoring today to work out a comprehensive, constructive solution of our business problems. We have taken definite steps toward getting at the real facts of industry from manufacturers. Within a few months we hope to be able to give manufacturers first-hand information about their business. I am satisfied from this investigation that the business men of the country are anxious and willing to co-operate with the commission. I know it. We are in receipt of thousands of letters expressing their appreciation of our efforts. In preparing this report on industries we have sent out many thousands of forms and the percentage of firms objecting to filling them out is almost negligible. This in itself is evidence of their willingness to do their part and assures us of a basis of fact upon which we can co-operate.

BENEFITS OF TRADE ORGANIZATIONS

The speaker then referred to the statement the Attorney General at Washington had made to the Federal Trade Committee of the Chamber of Commerce of the United States to the effect that in anti-trust cases no criminal action would be brought where there was doubt and where the parties acted in good faith, nor would there be any civil proceedings without giving the companies involved an opportunity to abandon a course of conduct regarded by the department as illegal. Mr. Hurley also quoted from President Wilson's recent letter to him saying that trade associations when organized for the purpose of improving conditions in their industries, such as unifying cost accounting and bookkeeping methods, should meet with approval. The 6500 commercial, industrial and trading organizations in the country, including 2500 chambers of commerce, were commended by the speaker for their efforts to improve systems of cost accounting and bettering manufacturing processes, standardizing output, obtaining accurate information and endeavoring to advance the welfare of their employees. Business and Government, he said, can co-operate through trade associations better than in any other way.

There should be a greater degree of organization and of mutual helpfulness in all lines of trade and industry, so that American business may be welded into a commercial and industrial whole, the part of the Government being to co-operate with business men, on request, to bring about the results that will benefit business, and hence promote our national welfare.

THE INSTITUTE A MODEL

I regard the American Iron and Steel Institute in many respects as a model trade association. For practically half a century this Institute and its predecessor, the American Iron and Steel Association, have worked for the betterment of your industry. This Institute's committee on welfare work has assisted in improving the conditions of your workmen. Its committee on improvement in methods has been a great factor in promoting the technical advance of your industry. Its committee on foreign relations has given you a broad, comprehensive view of foreign trade. Its Year Book and statistical reports, nowhere surpassed for completeness and accuracy, have kept you informed on the technical and industrial development of your industry. In short, it has been the organization through which you have co-operated for your mutual improvement, and I know that it will continue a powerful factor in the further progress of your great industry.

The standardization of products and processes has been extensively developed in the iron and steel industry both in Europe and in this country. Standard specifications for structural and boiler steel, steel rails, concrete re-enforcement bars, etc., have been agreed upon. Your Institute has done excellent work in this direction, and of itself and in co-operation with engineering societies and industrial experts I know it will do much more.

BETTERING CONDITIONS OF LABOR

The question of giving to our workmen continuous employment so that they may average longer periods of prosperity can be solved and other plans for their welfare can be worked out, through trade associations. As we have grown in manufacturing capacity we have come to realize that our employees are one of the most

important parts of a successful establishment. That management is successful which is not only efficient in working out economies in production, but which also has the real interests of its employees at heart and which is anxious to have as many of its employees stockholders as possible, and which also realizes that without the hearty co-operation and enthusiasm of their men the best results cannot be obtained. Many corporations and firms, particularly those in the iron and steel industry, are now raising salaries and wages without the request from their employees. These benefits are commendable and should be supplemented by movements for the general welfare, planned and put into effect by our trade associations.

The address then turned to the benefits of uniformity in cost accounting, the dangers of inadequate accounting methods, the necessity of reciprocal trade by which imports would increase along with exports. In the iron and steel industry the speaker considered the methods of accounting to be exceptionally good. "It is gratifying to know that practically all iron and steel manufacturers are recording and classifying their costs on a substantially uniform basis, are distributing their overhead expense by the same methods, and are adequately providing for depreciation and exhaustion."

OUR OPPORTUNITY IN RUSSIA

After the war, there is no question that many new economic conditions will be presented not only by the nations at war, but by our own and other neutral countries. After the war England, France, Russia, Italy, Belgium and their dependencies will, without a doubt, form a co-operative trade compact whereby they will agree to purchase from and sell to each other every possible commodity manufactured or produced by them.

When peace is again restored we will, for a while at least, be the leading export nation of the world; whether we retain this supremacy will depend largely upon the efficiency of our merchandising and industrial organization and the co-operation of our Government with business. These opportunities for trade exist in Latin America, in the Orient, in Russia, and elsewhere. Let me particularly mention the opportunities to be found in Russia. . . . Before the war 30 per cent of the products purchased by Russia from the United States and 20 per cent of the products purchased by the United States from Russia were handled through German commission houses in Berlin. We now have an opportunity to increase our trade. Buying and selling direct with Russia will save commissions, reduce the costs, and bring the business men of Russia and the United States in closer contact. American business has no greater trade opportunity to-day than the one presented by the Russian Empire.

COOPERATIVE SELLING FOR EXPORT

Nowhere is co-operation among business men, and between them and government, more essential than in the development of our foreign trade. The American people, including every day laborer, every clerk, every mechanic, every farmer, and every business man, large and small, are heartily in favor of Congress removing the doubt which now exists in the interpretation of the anti-trust laws when applied to organizations co-operating to further our export trade. Such relief will make it possible for us to obtain our share of foreign business so that our factories may run continuously and keep our workmen permanently employed.

The Federal Trade Commission has recommended to Congress that a bill be passed giving the American manufacturer the legal right to form co-operating selling agencies in export trade. The commission does not believe that Congress intended by the anti-trust laws to prevent Americans from co-operating in export trade for the purpose of competing effectively with foreigners, where such co-operation does not restrain trade within the United States and where no attempt is made to hinder American competitors from securing their due share of the trade.

If American business men are to make the most of the great opportunities now before them, are to build securely in foreign trade and are to avoid disaster in the shock of the stern and determined competition that will doubtless follow the war, they must at once perfect the organization demanded by the conditions of international trade.

United, in the spirit of co-operation and with the support of our Government, there is every reason to believe that we will succeed against all comers in the markets of the world.

The Electric Furnace in Steel Manufacture

BY DR. JOHN A. MATHEWS
President Halcolmb Steel Company, Syracuse, N. Y.

DR. JOHN A. MATHEWS

IT may be a surprise to many to learn how nearly the commercial introduction of electric steel coincides with the beginning of the 20th century. In fact, it antedates the new century by three days, according to Dr. H. Goldschmidt, who is my authority for stating that on Dec. 28, 1900, the first carload of electric steel was delivered by Heroult to Schneider & Co., Creusot, France. The shipment consisted of nearly 9000 kilos of steel bars.

In the last years of the 19th century much experimenting with electric furnaces was going on and many processes were perfected and patented all over the industrial world. Sales of the product may have been made earlier than the one recorded, either by Heroult or the other inventors, but they have not been made a matter of public record. Kjellin's furnace at Gysinge was first operated in March, 1900, while Captain Stassano, Girod, Harmet, Keller and others were very active during the closing years of the 19th century.

SIR WILLIAM SIEMENS, PIONEER

Electrometallurgy may be said to date from Sir William Siemens' experiments. He constructed and operated an arc furnace and patented it in 1878. In this furnace he melted iron, steel and other metals, and his remarks before the Society of Telegraph Engineers in 1880 are truly prophetic because we have of late seen his prophecy fulfilled. After some theoretical consideration of the power required to melt steel and a comparison of the same with the very expensive coke melting furnaces used in Sheffield, which require from 2½ to 3 tons of coke per ton of product, he concluded that

> the electric furnace may be, therefore, considered as being more economical than the ordinary air furnace and would, barring some incidental losses not included in the calculation, be, as regards economy of fuel, nearly equal to the regenerative gas furnace. It has, however, the following advantages in its favor:
>
> That the degree of temperature is theoretically unlimited.
>
> That fusion is effected in a perfectly neutral atmosphere.
>
> That the operation can be carried on in a laboratory without much preparation, and under the eye of the operator.
>
> That the limit of heat practically attainable with the use of ordinary refractory materials is very high, because in the

Electric and Crucible Steels Compared

Each process has its particular field. While some crucible tonnage may be diverted to electric steel, it is more likely that electric steel will find its market in the most exacting requirements of steel for structural and tensile purposes, as for automobile and aeroplane parts. Crucible steels for these purposes are scarcely commercial because of the difficulties in making very low and medium carbon alloy steels by that method with the tonnage demand far beyond what could be met by crucible steels.

electric furnace the fusing material is at a higher temperature than the crucible, whereas in ordinary fusion the temperature of the crucible exceeds that of the material fused within it.

SLOW DEVELOPMENT OF ELECTROMETALLURGY

Notwithstanding Siemens' words, electrometallurgy did not develop along iron and steel lines, but progress was made in other branches of the art, and to this pioneer work Americans have contributed richly. We need only recall the work of Cowles Brothers in 1885 and Hall in 1886 on aluminum; that Colby in 1887 invented the electric induction furnace; that Acheson produced carborundum in 1893 and artificial graphite in 1895; that Willson in 1893 produced calcium carbide, and that the manufacture of ferroalloys, especially of silicon and chromium, early received attention in the United States. These early achievements make more conspicuous our neglect of electric furnaces for steel making.

Smelting and refining of ores and alloys followed, and France, Italy and Sweden produced a group of inventors whose brilliant achievements have merited recognition from the whole iron and steel trade. To Germany and Austria belongs the credit of having first adopted commercially the inventions of others; and to the United States belongs the somewhat doubtful honor of having overtaken and passed all other nations in the introduction of electric steel furnaces. England has been particularly backward in introducing such furnaces to replace her very expensive crucible steel process, although rapid changes have taken place there within the past two years. It seems as though the too-enthusiastic claims of the inventors and their representatives in the early days had injured their cause in England, and their conservatism in adopting electric methods seems to be reflected in the remark of Sir Robert Hadfield, made some 10 years ago, that "unfortunately there seems to be fixed in the minds of some of those exploiting such processes the idea that all steel now made is radically of bad quality."

In sharp contrast with the initial backwardness of both England and the United States is the example of the Canadian Government which early recognized the possibilities of electric smelting, and as early as 1903, under instructions from the Minister of the Interior, Dr. Eugene Haanel, organized the commission which investigated the state of the art in Europe, and made its valuable report in 1904. The work of the commission was followed up in Canada by direct experiments upon smelting many of their native ores.

HALCOMB STEEL COMPANY, AMERICAN PIONEER

The Halcomb Steel Company first made electric steel on a commercial scale in the Western Hemisphere, and we have just entered upon our second decade of electric steel production. To be exact, our furnace was first operated on April 5, 1906, and we are beginning our second decade with the original furnace still in operation, while a 3-ton Snyder furnace—a purely American type—was installed during 1915, and a 6-ton Heroult furnace is now being erected. We take considerable pride in this priority of adoption, and it is a source of satisfaction to have witnessed the progress of the process at home and abroad and to have seen the judgment of the founders of the Halcomb Steel Company abundantly confirmed by large numbers of steel makers the world over, even by the big brother of us all, the United States Steel Corporation.

Five years after our installation was made there were only three other furnaces in the United States in steel works. The second installation was at the Firth-Sterling Steel Company, and the third and fourth were by the Illinois Steel Company and by the American Steel & Wire Company at Worcester. The last two furnaces were of 15 tons capacity, then the largest that had been built. Furnaces have now been built of from 20 to 30 tons capacity.

TYPES AND USES OF ELECTRIC FURNACES

In the earliest types of furnaces almost every system of utilizing the electric current for heating was employed, and no strictly new types have been developed since, although many mechanical and electrical modifications have been made. Many of these bear new names although they do not constitute radically new processes. The types electrically considered are:

(1) Pure arc furnaces, illustrated by the Stassano and, more recently, Rennerfelt processes; (2) arc-resistance furnaces, illustrated by the Heroult and the later Girod, Grönwall and Snyder types; (3) pure resistance furnaces, such as the Keller, Harmet and Heroult pig-iron furnaces, by the Gin process and the earlier Girod crucible furnace, and (4) induction furnaces, such as the Kjellin-Colby and its later modification, the Roechling-Rodenhauser type.

Metallurgically considered, electric furnaces have been put to several distinct uses in the iron industry:

(1) for making pig-iron, (2) for making steel direct from the ore, (3) for refining steel previously made in the open-hearth or Bessemer, (4) for making steel by melting cold scrap with or without the use of pig or ore, (5) for manufacturing ferroalloys, (6) for melting ferroalloys to be used as additions, and (7) for melting pig iron for malleable castings. The steel produced by second, third or fourth method may be put into ingots or castings.

DIFFICULT TO COMPARE PROCESSES

There are so many variables entering into the matter that no one can fairly compare these processes except, perhaps, in one or more particulars. For example, the current consumption can be readily compared, and we hear much about this or that furnace showing low current-consumption per ton. Unless furnaces compared are operating under similar conditions and on a similar product, the figures are quite valueless. In melting a similar quality, one furnace may take more current than another simply because the melter kills his steel more perfectly. A few extra kilowatts makes the difference between well and poorly made steel.

Beside current-consumption, other variables are life of roofs, bottoms, side-walls and electrodes. First cost of furnaces and quality of construction, and, from the power house point of view, simplicity and cost of electrical equipment, must be considered, and this involves questions of phases, frequency, voltage and power-factor. When all elements are considered, together with ease of operation, we see that it is no simple matter to give off-hand judgment as to what furnace to use. I mention this because I am so frequently asked this question, and I notice a considerable tendency upon the part of those with no electrical furnace experience at all to install relatively new and untried processes rather than those that have unquestionably proven their merits.

The time has passed when the electric current itself is supposed to confer any mysterious benefits upon the product, but its function is just as stated by Siemens 35 years ago, namely, to

effect such reactions and decompositions as require for their accomplishment an intense degree of heat, coupled with

freedom from such disturbing influences as are inseparable from a furnace worked by the combustion of carbonaceous materials.

Various claims, however, are made for processes depending upon whether the current passes through the bath horizontally or vertically or is merely radiated upon the surface. Mixing or circulation in the bath is supposed to be especially facilitated by whichever process the speaker happens to be interested in. At the temperatures involved, molecular mobility is very great, and solution and diffusion take place satisfactorily if only the total heat available is sufficient to maintain the entire contents of the bath perfectly fluid. Aside from this condition, it is my judgment that excessive agitation of the bath by the current is just about as desirable as "agitation" elsewhere in the plant among employees.

The condition for perfect melting described by Siemens has best been met for a 160 years by the crucible process, which has been held in highest esteem where quality is considered. Crucible steel production, after a century of supremacy, was given a setback for ordinary uses by the invention of Bessemer steel, and a little later the crucible industry was again assailed by the Siemens-Martin product, particularly after the advent of the basic process. Neither of those processes give a product that competes with crucible steel where highest quality is demanded, and the venerable crucible process thrives notwithstanding these earlier rivals.

ELECTRIC AND CRUCIBLE RESULTS COMPARED

With the advent of electric furnaces we have a rival which claims to make steel equal to the best crucible steel. It is interesting to note that the inventors recognized the superior character of the crucible product so frankly. Equally frankly I can say, after 10 years' experience, that I think they were right; nevertheless, we are building four new crucible furnaces at the present moment.

When I say that the electric furnace can produce steel equal to crucible steel, I mean that conditions in the furnace are such that the metal in the ladle, ready to pour, is in approximately the same condition as well-melted crucible steel. The quality of the finished product, however, depends upon the use of equally good methods of handling the ingot in cogging, rolling, annealing and inspecting that are customary in handling fine tool steel.

The point is that each process has its particular field, and while some crucible tonnage may be diverted to electric steel, yet it is more likely that electric steel will find its market in the most exacting requirements of steel for structural and tensile purposes, such as have come about almost simultaneously with the processes themselves, namely, for automobile and aeroplane parts. Crucible steels for these purposes are scarcely commercial because of the difficulties attendant upon making very low or medium carbon alloy steels by that method, and the tonnage demand is far beyond what could be met by crucible steels.

Our own experience shows that the electric furnace was opportunely invented to meet a new demand rather than to replace an old process. Our demand for crucible products has not decreased, but the reverse; and while each and every grade that we manufacture can be and has been successfully produced in one or both of our electrical processes, the fact remains that they are better adapted to the production of relatively low carbon alloy steels.

SKILL IN THE ELECTRIC PROCESS

The pioneer work that we have done in introducing electric steels into this country has had the effect of creating new standards of value for alloy products and, indirectly, has brought about a general improvement in the quality of open-hearth steels upon the part of mills specializing in these products. Of this there can be no doubt.

The recent activity—epidemic, we might call it—of electric furnace installations calls for some comment and caution. THE IRON AGE published on Jan. 6, 1916, an interesting summary of the world's installations.

Corporation's Electric Steel Output

The United States Steel Corporation will soon be producing about 1000 tons of electric steel ingots per 24 hours. At the Duquesne works of the Carnegie Steel Company a 20-ton Heroult furnace is being built. At the South Chicago works of the Illinois Steel Company two 20-ton and one 15-ton Heroult furnaces are under construction, where a 15-ton furnace has been in operation for several years. These installations will make the corporation the largest producer of electric steel and bring the country's tonnage output capacity to at least 1,000,000 tons per year.

It is noticeable that many of these are going into plants not formerly engaged in steel making at all, and this, in conjunction with the hesitancy of established plants to adopt electric melting, leads one to look for a reason. It is in part due, I fear, to the activity of power companies in looking for desirable business; but while the electric furnace load is generally desirable, it can only remain so if the plants of the users are successful. On the part of those who have recently made these installations, I fear there may be some misapprehension as to just what an electric furnace will do. It is not an automatic machine guaranteed to produce steel of crucible quality by merely throwing on a switch. It requires at least as much skill as any other existing process, and the number of those possessing this skill is limited. I believe we will pass through a period of reaction and dissatisfaction with electric products while many of the new furnaces are in the experimental stage.

ADAPTABILITY OF ELECTRIC PROCESSES

To one who has been interested in electric steel from its earliest days, it is interesting to observe the change in attitude toward the actual carrying out of the processes and the feasibility of establishing them in widely scattered districts. We formerly thought, and were repeatedly told, that it would be impracticable to utilize electrical energy to do the original melting, that only in most-favored localities could these processes be operated at all, and then only for making the highest-grade products. In accordance with the prevailing idea, our initial installation consisted of a single-phase, 4-ton electric, fed by a 20-ton Wellman-Seaver tilting basic open-hearth furnace. At that time 4 tons was as large a furnace as had been made, and nothing but single-phase current had been used. The initial installation of Richard Lindenberg, in Germany, was practically identical and started operating at almost the same time. The current was used for refining only, and our furnace was not suitable for cold melting, although a few heats have been so made.

One of these is of peculiar historic interest because our charge consisted of electric pig iron, made in the Canadian experiments under the direction of Dr. Haanel. The particular pig iron used was made from roasted pyrrhotite ores and was described by Dr. Haanel in 1906 in the "Preliminary Report on the Smelting of Canadian Iron Ores by the Electro-Thermic Process." Some of this material was later smelted by us in March, 1909, under the supervision of Ernest Humbert, who furnished the following analyses of the iron used:

Nickel Per Cent.	Copper Per Cent.	Silver Per Cent.	Sulphur Per Cent.	Phosphorus Per Cent.
4.35	.72	2.95	.020	.030
3.13	.80	2.31	.013	.023
4.15	.82	2.39	.012	.027

The heat made from this iron gave the following analysis and represents the first steel made in the Western Hemisphere direct from the ore in two operations, both of which employed electric furnaces of the Heroult type:

	Per Cent.		Per Cent.
Carbon	0.44	Sulphur	0.013
Silver	0.034	Nickel	3.62
Manganese	0.50	Copper	0.48
Phosphorus	0.013		

The high copper content led us to test this heat very thoroughly. The results were published by the writer in the *Proceedings* of the American Society for Testing Materials, Vol. X, 1910. The physical characteristics were very good indeed and showed no harmful effects from the copper.

Of the later installations of electric furnaces, probably one-half are intended to melt and refine cold charges, even in localities not especially favored as regards power rates. However, there has been a very general decrease in wholesale power rates during the last few years, and this applies to steam as well as hydroelectric sources of power. Rates below 1c. per kilowatt may be had in very many localities for large quantities of power steadily used.

CHANGES IN ELECTRICAL EQUIPMENT

The most marked change in the electrical equipment of furnaces consists in the larger quantity of power deemed necessary for a given size of furnace. In our original furnace we have 550 kva. for a 4-ton furnace. To-day the United States Steel Corporation recommends 900 kva. for a furnace of this size. Some of the older 6-ton furnaces have from 900 to 1000 kva. available; 1200 kva. is now standard, and one furnace is to have 1500 kva. The Snyder furnace has 800 kva. available for a 3-ton furnace, and the Heroult furnaces, as installed in this country, are now equipped with 750 kva. for this capacity. It has been found that increased power during the melting-down stage is very desirable and brings about a saving in total kilowatts expended. After the melting is complete excessive power is detrimental to the heat itself and very destructive of roofs and linings.

It is possible to make electric steel chemically purer than by any other process. Phosphorus with us rarely exceeds 0.010 per cent, and sulphur in carbon heats will average still lower, while in alloy heats the sulphur rarely exceeds 0.015 per cent. This is true of both the Heroult and Snyder product; in fact, I have seen eight consecutive heats showing sulphur and phosphorus below 0.010 per cent. In the case of sulphur, we view this not so much as of itself important, but as an indication of the success in attaining a reducing and deoxidizing condition during the operation.

In the case of both low and high carbon heats of a great variety of compositions, we have split many ingots in two and have never seen a cavity or blowhole, either subcutaneous or deep-seated, even so large as a pinhead. This is no positive guarantee that unsound ingots may not result even with electric steel, and the approved methods of pipe prevention must be employed, together with every possible care in melting and pouring. Even with the use of all these precautions, the same results cannot be obtained in open-hearth and Bessemer steel, owing to the oxidizing conditions of operation.

TIMELINESS OF THE ELECTRIC PROCESS

This shows how timely was the invention and development of electrical processes simultaneously with the advent of the automobile and aeroplane. New requirements for materials of construction came into being along with them and it is in meeting these requirements the electric furnace finds its best application. In the construction of automobiles and aeroplanes, it is little short of criminal to use any materials but the best when human life is at stake and when safety cannot be had by merely increasing the weight of vital parts. In our 10 years' experience in introducing electric alloy steels, I can safely say that a large part of our business came from those who had had a more or less unsatisfactory experience with other grades of steel, and we have furnished much steel for racing cars to those who did not use it in their general product, but who thus displayed both a sense of added responsibility commensurate with the requirements and a recognition of the merits of electric steel.

An advantage of the electric product scarcely anticipated by Siemens is the ability to control the composition within narrower limits than are possible in open-hearth practice. This is especially noticeable in the use of the more easily oxidizable metals, such as silicon, manganese, chromium and vanadium. This is an advantage in several ways: First, less excess alloy needs to be added to the heat to ensure the proper amount in the finished steel. Second, the quantity of solid metallic oxides in the steel, or to be eliminated from the steel, is thereby reduced. And, third, the more nearly composition can be controlled the more certain will be the results of heat-treatment.

Both the maker and the user of the steel are the gainers by reason of the above characteristics, as well as by the fact that all alloy additions may be made in the furnace itself rather than in the ladle, thereby removing danger from lack of homogeneity.

Not only in automobiles and aeroplanes, but in many other ways, electric steel will give a good account of itself here, as it has done abroad, for military and naval purposes. But I cannot discuss that lest I be deemed an alarmist, or a member of the munitions trust, or in some way identified with those evil influences stalking abroad in the land.

In 1910 there were 10 electric furnaces in the United States and 104 elsewhere in the world. In 1913, 19 against 121; in 1915, 41 against 172; while at present there are no less than 100 either operating or under construction as against probably 250 elsewhere.

The furnaces already installed in this country, or now being built, represent the utilization of between 125,000 and 135,000 electrical horsepower and will be capable of a tonnage output of between 1,000,000 and 1,100,000 tons of ignots or castings per annum. The Heroult system represents at least 70 per cent of this electrical energy and tonnage output.

THE STEEL CORPORATION'S NEW FURNACES

The recent announcement of electric furnace development in the plants of the United States Steel Corporation is deserving of especial mention here because of the magnitude of the installations. At the Duquesne Works of the Carnegie Steel Company, a 20-ton Heroult furnace is now under construction, which will operate on liquid open-hearth metal from any of the 32 open-hearth furnaces at that plant. It is estimated this furnace will produce about 200 tons of ingots per day of 24 hours.

At the South Chicago Works of the Illinois Steel Company, where a 15-ton furnace has been in operation for several years, three additional electric furnaces, two of 20 tons and one of 15 tons' capacity, are now under construction. These furnaces will receive liquid open-hearth metal from the duplex plant, consisting of three 200-ton rolling open-hearth furnaces and two 25-ton Bessemer converters, also under construction at these works. This installation, when completed, it is estimated, will produce 800 tons of electric steel ingots per day and will represent by far the largest electric furnace installation in the world.

If preparation ever becomes a reality, we shall not have to apologize for our quality in comparison with any industrial or warring rival—at least so far as the product of privately owned plants is concerned; and, in the tonnage capacity of electric furnaces installed, we now take first place among steel-making nations, as we also do in Bessemer, open-hearth and crucible steel production.

Discussions

BY CARL H. BOOTH

Treasurer Snyder Electric Furnace Company, Chicago

In discussing electric furnaces with prospective users, we have always held that any type of electric furnace, properly designed and constructed, if operated

with sufficient metallurgical skill, could be used to make the highest grade of steel. Dr. Mathews has developed this thought, with special emphasis upon the necessity of having skilled handling, which we consider a matter of first importance. Many electric furnaces have been damned because of improper handling on the part of operators.

But we have always gone one step further and urged that, in the last analysis, the question of the cost of operation was equally important. This is especially true if the electric furnace is to have any wide application in the manufacture of the commoner grades of steel, which at present are made by the Bessemer converter and open-hearth processes. It is also equally important to have low cost of operation if electric furnaces are to stay in the business when the manufacturer of steel again returns to a normal basis and when the net profit made is frequently measured by $1 per ton.

To secure high efficiency and low cost operation, we believe that furnaces should be built of relatively small holding capacity, should be high powered and use but one electrode. This results in a furnace of high thermal efficiency, of low electrode consumption, and with an operating cost considerably lower than the best records made with the older types of electric furnaces having the same daily output and producing a similar grade of steel.

Dr. Mathews comments on the changed attitude toward using electrical energy to do the original melting. We believe the Snyder furnace has had a large part in bringing about this change. Snyder furnaces to-day, melting and refining cold material, on a basic bottom, are making from 6 to 12 heats in 24 hr., depending on the grade of steel made and the methods used for handling the metal. It is not at all uncommon to melt down an entire charge of cold scrap in 1½ hr., and we have many records where the actual melting has been done in 1 hr. and 10 min.

This quick melting ability in an electric furnace makes unnecessary and expensive the use of other furnaces, such as the open-hearth or Bessemer, either to do the preliminary melting, or part of the refining. We believe that the developments of the future will be in the direction of doing all work in the electric furnace, except in cases where hot blast-furnace or mixer metal is available as raw material, for use direct in the electric furnace.

Dr. Mathews has also pointed out the decided advantage which the electric furnace has, due to its neutral atmosphere and its ability to make steel chemically purer than by any other process. It is quite evident that if the entire steelmaking operation is carried on in the electric furnace, considerably less deoxidizing and alloy additions will be required for cleaning the steel and removing oxides, nitrides and occluded gases.

We are designing at this time an electric furnace of approximately 12 tons holding capacity, which will have a daily output of 100 tons of steel, melting and refining cold scrap on a basic bottom. The steel made would have an analysis equal to the best low carbon, open-hearth steel, and the operating cost promises to be low enough to compare favorably with an open-hearth furnace having a daily output of 100 tons.

BY LESLIE E. HOWARD

Metallurgist, Simonds Mfg. Company, Lockport, N. Y.

Our experience has been entirely with small furnaces of the conducting hearth type. In 1910 we put down at the Chicago plant of the Simonds Manufacturing Company what we believe to be the first Girod furnace in this country, of ½-ton capacity and single phase. This was moved to Lockport in the early part of 1911 and was used entirely on experimental work, and the production of special steels, some of which we have not been able to make successfully in the crucible furnace.

Some two years ago this Girod furnace was replaced by a furnace designed and built by ourselves, this being along the lines of the original Siemens furnace, having but one bottom electrode, welded by acetylene to the shell with the conductors so arranged that the shell forms part of the conductor to the bottom electrode. This furnace is of 1-ton capacity and has operated very successfully indeed, and has also been used in producing high grade carbon steels as well as alloy steels. We mention this as showing that our experience has been entirely with these small furnaces and our comments will necessarily be considered with this in mind.

I thoroughly believe, as stated by Dr. Mathews, that steel equal to crucible steel can and is being produced every day by electric furnaces, but our experience, limited though it, has convinced me that to do this we must follow very closely crucible practice in the choosing of melting stock, care being taken in melting, especially during the killing period and, of course, extreme care in pouring and subsequent handling of the ingots.

I was glad to see Dr. Mathews bring out the point that high grade steel cannot be made of any or every thing in the way of steel scrap, for personally I don't believe this is possible to do, or if so, the extra furnace cost in the way of extra refining would offset the difference in cost of the melting stock.

We are also firmly of the opinion that a certain amount of new iron should be added to even high grade scrap if quality steel is to be produced. The writer has had occasion to talk with several Sheffield melters and metallurgists and they will tell you over there that to get "body" and "life" in their steel, they are obliged to use liberal quantities of new iron, this holding good whether the steel is made by the crucible or other process.

In American crucible practice it, of course, is well known that liberal additions of puddled iron, either Swedish or American, give crucible steel increased physical properties for the same analyses, and having in mind that the puddling process is about as crude an operation as we have in our iron and steel metallurgy, the writer cannot see why the same proportionate amounts of high grade pig iron combined with good scrap and all melted and refined in the electric furnace will not make steel equal to crucible quality.

The point I want to make is that the reduction and refining of the pig-iron addition will be carried out under very much better conditions in the electric furnace than in the puddling furnace. Our experience along these lines has been conclusive to the extent that we have installed and are now running a 6-ton, 3-phase Heroult furnace and we have every reason to feel that results from this installation will be as successful as have been the results of the small furnaces. We do feel, however, that there is a limit as to how large a heat can be properly worked in an electric furnace and get quality steel, especially when dealing with high carbon steels, and we are awaiting with some interest results from our new 6-ton furnace along these lines.

BY W. G. KRANZ

Vice-President National Malleable Castings Company, Sharon, Pa.

One cannot but be impressed with the rapid growth in the production of steel in the electric furnace, when you consider the development that has taken place in less than 16 years, with the capacity of furnaces installed and building of over 1,000,000 tons per year. We are acquainted with large figures these days, but must not forget that the first million is by far the most difficult to acquire, and in my judgment the next period of 16 years will show a much greater rate of progress than the past.

In 1912 The National Malleable Castings Company installed a 6-ton Heroult furnace at its Sharon Works for the production of a special steel, and during the past few months a second furnace of the same type has been added. The electric furnace was found to be much better adapted for this purpose than the open-hearth.

Dr. Mathews mentioned the melting of pig iron for malleable iron purposes. This use of the electric furnace is yet in its infancy. There has been some experimenting along this line with gratifying results thus far and I look for considerable development in the near future not only in the manufacture of malleable iron, but also in the manufacture of iron castings, such as

chill rolls, car wheels, etc., where uniformity and exacting analysis is required.

The electric furnace has not only come at an opportune time to take care of the automobile and aeroplane industry, as referred to, but it will set higher standards of quality which will spur the ingenuity of the steel maker to improve the quality of Bessemer and open-hearth materials and thus the electric furnace should be heralded as a beneficial acquisition to the entire steel industry.

Distribution of Raw Materials in the Blast Furnace

BY GEORGE W. VREELAND

Superintendent of blast furnaces, Carnegie Steel Company, Mingo Junction, Ohio.

GEORGE W. VREELAND

ON our large furnaces, with their big tonnages, the errors of faulty distribution are more evident than on the smaller furnaces, due to the more rapid rate of driving; but that these errors exist on the small hand-filled furnaces, even with the most approved methods of charging, cannot be denied. Up to the present time, however, no change in the distributing equipment has produced such uniformly good results as to lead to its general adoption, nor has any one top shown conspicuous superiority over all others.

With poor distribution, the results on the furnace would not be quite so bad were the chemical constituents of the fine and coarse materials approximately the same; but poor physical distribution is always accompanied by poor chemical distribution. I will not attempt to discuss the question of thorough screening of coke and stone at this time, but it is the universal opinion of furnace operators that these two materials should be as free from dust and foreign material as it is commercially possible to make them. The treatment and preparation of the raw materials are receiving more attention at the present time than ever before, and we should not undo some of the work that is being done along this line through faulty and improperly designed furnace tops. By a study of the six accompanying diagrams, which represent five Mesaba ores (A, B, C. D and E), and one very excellent Old Range ore (F), it is readily seen that the percentage of silica in the fines of all these ores is several times as much as it is in the coarser material. That this same variation in analyses occurs in the stone and coke is shown by a brief glance at the accompanying table of sieve tests:

Sieve Tests and Analyses of Limestone

	Per Cent on Sieve	Per Cent SiO_2	Per Cent AL_2O_3	P	Fe_2O_3	CaO	MgO	S
¼ inch	84.71	4.09	1.92	.024	2.90	50.45	.61	.075
20	6.73	8.01	3.23	.040	11.51	43.44	.45	.108
40	3.34	10.04	3.69	.050	26.90	32.59	.44	.076
60	1.08	10.41	5.77	.061	32.23	26.23	.45	.135
80	.72	13.52	4.49	.069	33.23	24.22	.41	.082
100	.36	18.09	6.84	.072	36.40	20.79	.45	.139
Pan	3.06	14.73	6.38	.077	32.66	20.89	.51	.131

Analysis of Connellsville Coke and Coke Ash

	Ash	SiO_2	S.	P.	Vol. Matter	Fixed. C	Avail. C*
Coke A	9.13	4.49	.678	.010	1.45	88.51	83.17
Dust	29.19	11.83	1.054	.016	4.22	65.63	49.40
Coke B	11.53	5.84	.944	.016	1.10	86.48	79.67
Dust	22.90	11.47	1.472	.021	1.73	71.67	58.44
Coke C	9.17	4.75	.721	.009	1.98	87.85	82.46
Dust	19.23	9.25	.800	.014	5.14	72.63	61.85
Coke D	11.52	5.70	.953	.013	1.38	87.22	80.41
Dust	24.36	10.48	1.277	.022	3.50	72.14	58.54
Coke E	11.47	5.99	.839	.010	2.16	86.37	79.78
Dust	23.99	12.61	1.890	.018	4.96	71.05	56.94
Coke F	12.18	6.16	.885	.011	1.11	87.00	79.86
Dust	26.33	13.13	1.085	.015	3.47	70.20	55.45

* Available carbon—Total fixed carbon minus that necessary to take care of ash and sulphur of coke; also bases to form slag.

BAD DISTRIBUTION AND THE REMEDY

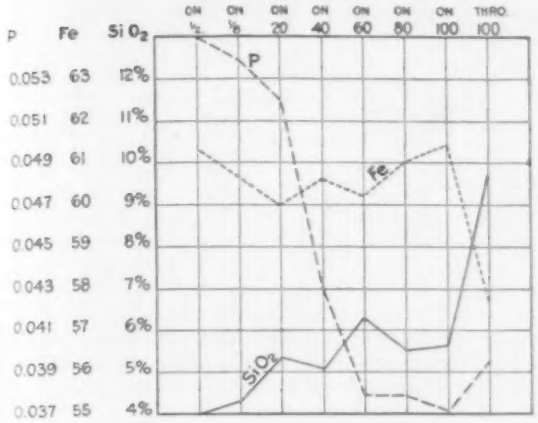
It is my opinion that ideal distribution, under present conditions, is attained when the materials comprised in any one charge of the furnace burden are so deposited in the furnace that physically and chemically any one sector is the exact counterpart of any other sector, and on any horizontal plane a sector of material shows the maximum fines at the periphery, and a diminution of fines and a corresponding increase of lumps towards the center of the furnace.

Faulty distribution may take a form wherein an excess of the coarser materials is thrown to the walls and an excess of fines deposited toward the center, which is usually repeated with every bell dumped. Under such conditions the ascending gases will follow the lines of least resistance, and as the coarser materials are more easily penetrable, the gases, because of their tremendous reducing power and their high speed of travel, and by reason of the scouring action of the dust which they carry in ascending through the vertical ring, will cut the lining. If this is not promptly observed and corrected, economical operation is out of the question. This has been very closely watched, especially in later years, and often checked in time by the adjustment of one or more of the factors of distribution, resulting in better operation and longer life of the furnace. Such changes as these, wherein an attempt is made to correct some of the inherent defects of a faulty distribution, is dependent upon the closeness of observation of the operator, and when the effects of bad distribution manifest themselves, changes can be made which may correct the evil, but usually after many trials and disappointments.

In some cases the order of charging the materials has been changed, speed and angle of dump of the skip changed, and often where certain tuyeres showed the greatest activity and an excessive quantity of coarser materials, one or more of these very active tuyeres have been plugged, thus reducing the activity of that portion of the furnace. This latter course is only a makeshift measure and is merely an attempt to take care of a faulty distribution by an unequal wind distribution. It is but choosing the less of two evils. Under such conditions the bosh above the plugged tuyere or tuyeres will become inactive and allow an accumulation of half reduced ore, coke and stone, which in a short time becomes too heavy, slips into the hearth and chills the iron there in proportion to the amount precipitated. Also, when such faulty distribution exists, the coarse materials in the charge reach the tuyeres in a high state of reduction; and the finer materials, which offer more resistance to the reducing gases, reach this zone in such a condition that the reduction must be completed by solid carbon, which means a tremendous endothermic action. Finer stone, with lower fluxing efficiency, and finer coke, with lower calorific value, invariably accompany the finer ores. Thus at that portion of the furnace where we require the greatest amount of carbon to carry on the direct reduction and produce heat, we are not supplied with the agents for meeting the conditions.

Faulty distribution increases the amount of flue dust more than any other cause, due in some measure to the vertical shearing action between the sides with the high and low percentages of fines. This in turn causes an irregular descent of the charge, thus creating a disturbance which permits the gases to pick up the finer materials and carry them into the flues. It also increases the top temperature, which is uneconomical.

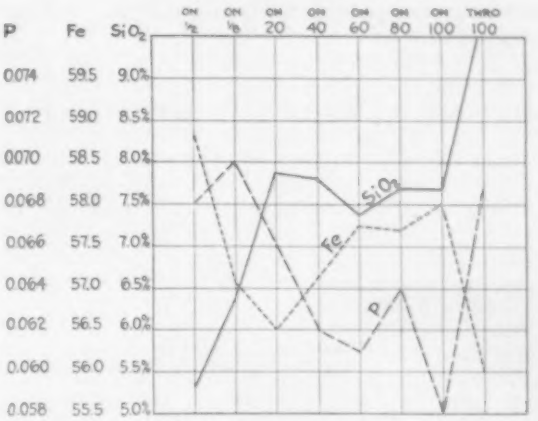
ORE A
GRAPHIC ANALYSIS OF SIFTINGS



SIEVE TEST

	ON ½	ON ⅛	ON 20	ON 40	ON 60	ON 80	ON 100	THRO 100
	% 29.06	% 19.82	% 8.05	% 9.52	% 14.78	% 0.95	% 1.16	% 16.66
SiO_2	4.00	4.20	5.30	5.05	6.35	5.55	5.70	9.80

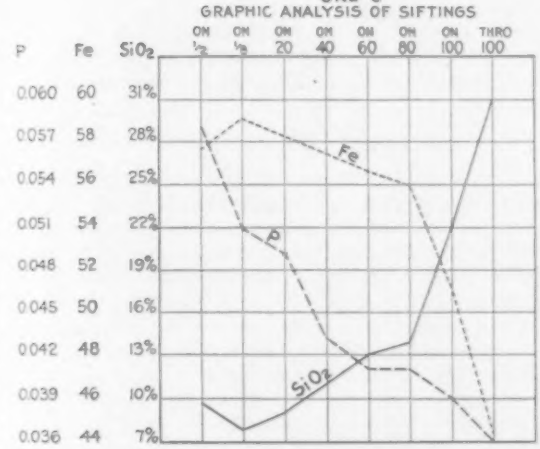
ORE B
GRAPHIC ANALYSIS OF SIFTINGS



SIEVE TEST

	ON ½	ON ⅛	ON 20	ON 40	ON 60	ON 80	ON 100	THRO 100
	% 23.81	% 39.35	% 16.79	% 8.65	% 3.70	% 1.31	% 1.00	% 5.39
SiO_2	5.19	6.37	7.86	7.74	7.45	7.68	7.64	9.80

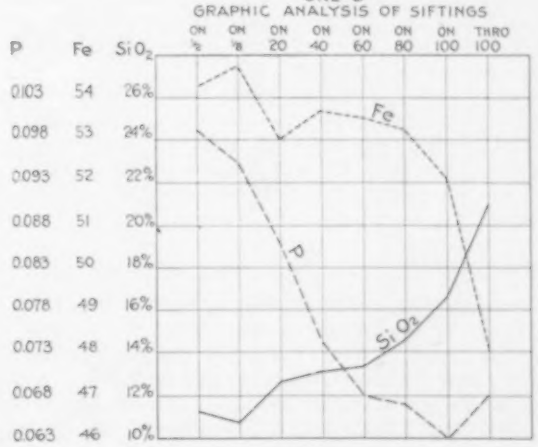
ORE C
GRAPHIC ANALYSIS OF SIFTINGS



SIEVE TEST

	ON ½	ON ⅛	ON 20	ON 40	ON 60	ON 80	ON 100	THRO 100
	% 26.17	% 23.86	% 11.31	% 11.43	% 9.23	% 3.23	% 3.82	% 10.98
SiO_2	9.80	7.73	9.24	11.49	12.99	13.93	21.24	31.48

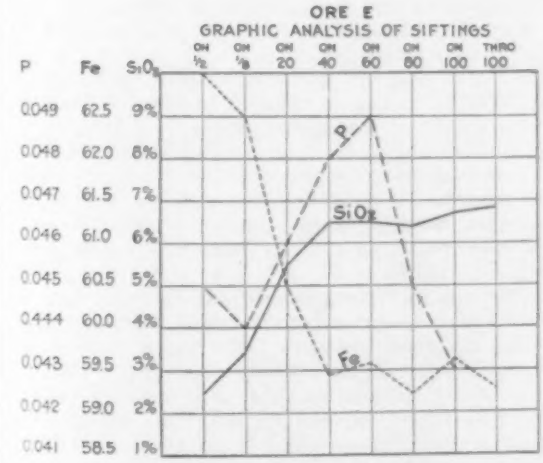
ORE D
GRAPHIC ANALYSIS OF SIFTINGS



SIEVE TEST

	ON ½	ON ⅛	ON 20	ON 40	ON 60	ON 80	ON 100	THRO 100
	% 32.15	% 25.30	% 12.15	% 8.83	% 4.98	% 3.42	% 2.48	% 10.69
SiO_2	11.23	10.76	12.72	13.08	13.48	14.59	16.71	21.30

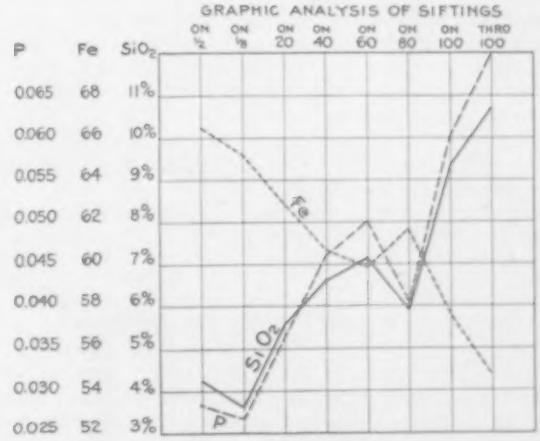
ORE E
GRAPHIC ANALYSIS OF SIFTINGS



SIEVE TEST

	ON ½	ON ⅛	ON 20	ON 40	ON 60	ON 80	ON 100	THRO 100
	% 37.91	% 23.57	% 7.37	% 9.15	% 1.88	% 3.40	% 4.93	% 11.79
SiO_2	2.63	3.34	5.63	6.40	6.56	6.47	6.74	6.93

ORE F
GRAPHIC ANALYSIS OF SIFTINGS



SIEVE TEST

	ON ½	ON ⅛	ON 20	ON 40	ON 60	ON 80	ON 100	THRO 100
	% 17.00	% 43.50	% 17.00	% 7.20	% 4.30	% 0.30	% 8.50	% 2.20
SiO_2	4.29	3.60	5.58	6.62	7.19	5.87	9.26	10.69

Should faulty distribution deposit too much fine material at the walls of the furnace, or in a ring concentric with the periphery of the furnace, evils equally as serious as those mentioned above but of a different nature result.

In my opinion, among the many improvements which have contributed to the more economical and efficient practice of the last few years, proper credit must be given to the better adjustment of the flexible factors of distribution, such as the dumping angle of the skip relative to the center line of the furnace, speed of dumping, changes in the receiving hopper and skip, changes in the order of charging the material, the order of dumping both on the small and on the large bell, changes in the size and angle of the large bell, and other factors with which blast furnace operators are familiar.

The better mechanical preparation of the raw materials, through screening of the coke and stone and better mixing of the ores in the ore region, also contributed. These latter not only assist in the mechanical feature of distribution but in the proper chemical distribution as well, as is shown by the analyses of materials referred to elsewhere. I believe that the tendency of to-day to increase the diameter of the hearth and steepen the angle of the bosh, while not eliminating entirely the evils of poor distribution, tends in a great measure to counteract them. Beyond a doubt, the bosh conditions have been improved, and this helps considerably in the more regular descent of the material and prevents excessive accumulation of the fine materials on the walls of the furnace.

[Mr. Vreeland described briefly various furnace tops, including the Brown top, the straight double-bell top, the McKee revolving top, the Baker-Neuman revolving top, the Kennedy top and the Neeland top, the last of which he regards as "a most excellent filling system."]

METHOD OF PLACING MATERIALS ON LARGE BELL

The large charge of 14,000 to 16,000 lb. of coke and 30,000 to 35,000 lb. of ore, with the necessary amount of stone, forms thick, heavy layers of each material; and although the coke does not offer much resistance to the gas, the heavy layers of ore, especially that part thrown toward the center of the furnace, prevents the free ascent of the gases. The gases in their ascent, following the paths of least resistance, cause imperfect and incomplete reduction of the ores in the denser part of the charge. This condition can be overcome only by direct carbon reduction in the lower part of the furnace.

To remedy this the charge is often split in two, thereby cutting the layers in half, which gives us a ring of ore of maximum thickness near the walls, tapering off gradually toward the center, where the lumps have a tendency to roll. This method has been demonstrated to be an improvement over the large charge, but a condition may arise wherein we have too much ore close to the walls, and too much coke toward the center. This would cause the center to travel too fast with respect to the materials close to the walls and result in greater loss in flue dust.

This system of charging was effected by filling and operating the bell as follows—assuming for illustration, a 15,000 lb. coke charge:

7,500 lb. coke on large bell—Dumped into furnace.
½ stone and ½ ore on large bell—Dumped into furnace.
7,500 lb. coke ½ stone and ½ ore on large bell—Dumped into furnace.

The first section gives us a thin layer of coke practically uniform in thickness over the entire area of the furnace, with the ore and stone intimately mixed and deposited close to the walls, some of the lumps rolling toward the center. In the succeeding section the coke is placed on the large bell and the ore and stone intimately mixed on top of it; and, on lowering the bell to deposit the charge, it is observed that only a small part of the coke leaves the bell before the ore and stone begin to break through and mix with the coke falling from the large bell into the furnace. As this section lies in the furnace, it is found that we have a very thorough mixture of ore, coke and stone throughout the entire layer.

That this method of filling and distribution in the furnace is satisfactory is proved by the work of one of our Mingo furnaces for the year 1915:

Average tonnage per day.....	534.4 tons.
Average coke per ton of pig iron	1,994 tons.
Average loss	2.29 per cent.
Blast temperature.....	891 deg. Fahr.

The blast temperature of 891 deg. is particularly noticeable, it being all the stoves will develop; and when we compare this furnace with other furnaces working similar raw materials with stoves capable of giving an average temperature of 1200 deg., we must give some credit to the filling method described.

A proof that this method of charging is conducive to good results is this: On changing to the thick coke and ore layer, we were unable with the same burden to maintain our hearth temperatures with the heat at our command; and not even in the face of a 10 per cent reduction in the ore burden did the temperature return. On changing the filling back to the other method, the furnace returned to its normal condition as soon as the charge reached the tuyeres. This was done on two separate occasions with the same results.

Many methods of placing the materials on the large bell and depositing them in the furnace are now in use and I have experimented with a large number of them; but the method described above has given very satisfactory results over a long period of time and may prove of value to other operators under similar conditions, especially where a large percentage of fine ores are used.

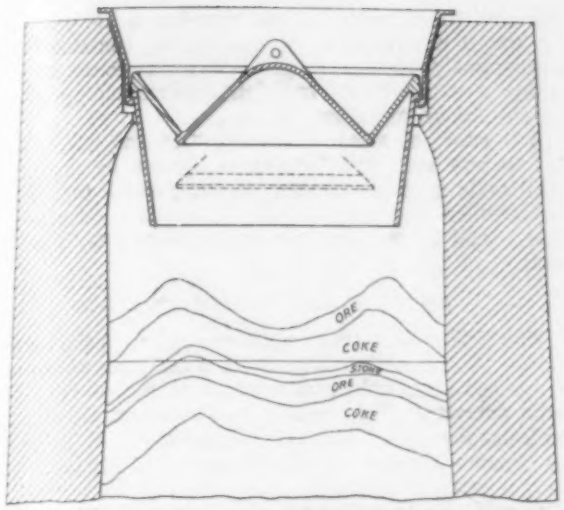
THE LARGE BELL AND DISTRIBUTORS

The almost universal use of the large bell, without distributors of any kind, has standardized its dimensions for furnaces of various stock lines and those using Lake ores. After a careful examination of a large number of furnaces, it was found that the diameter of the bell is generally 4 ft. less than the diameter of the furnace stock line, although there are a few cases where this difference in diameter is somewhat less, but the figure mentioned seems to be the accepted one on large furnaces with 15 ft. to 17 ft. stock lines.

The angle of the bell in many cases has been increased from 45 deg., the standard for many years, to as high as 53 deg., and the entire surface machined. This has been done in order that the wet and sticky ores will clear the bell and spread in a uniform stratum over its entire circumference. If the ore leaves the bell in an uneven stream after the lowering of the bell is started, it will cause the bell to swing, and the materials yet to leave the bell will disturb the distribution and the lay of the raw materials in the furnace.

The Killeen stationary distributor consists of a tapered cast steel ring, about 6 ft. 6 in. long and 11 ft. to 11 ft. 6 in. in diameter at the smaller or lower end. The large bell is reduced to about 9 ft. 6 in. in diameter. These dimensions apply to furnaces with a top 16 ft. to 17 ft. in diameter. The material leaves the large bell, strikes the distributor and is deposited in a ring, as illustrated. This gives a ring with the maximum fines, the apex of which is about 3 ft. away from the wall, the coarser materials rolling to the center and to the wall.

The idea in designing this distributing ring was to throw the coarser materials closer to the walls, affording an easier passage of the gases, thereby maintaining cleaner walls. During the time of the lower percentage of Mesaba and higher percentage of coarser ores, this ring produced results that compared very favorably with those obtained on furnaces using the large bell and no ring. As the Lake ores increased in fines, however, furnaces equipped with the Killeen distributor experienced more and more trouble with high pressures and irregular movement of the stock with resultant high coke and low tonnages. It was readily seen that though our walls were kept comparatively clean, we were unable to force the air and gases through the heavy mass of iron-bearing material so far away from the tuyeres. The physical conditions of the ores finally reached that point where it was almost im-



Killeen Stationary Distributor and the Manner in Which the Materials Are Deposited

possible to keep the furnace moving and it was necessary to go to the large bell.

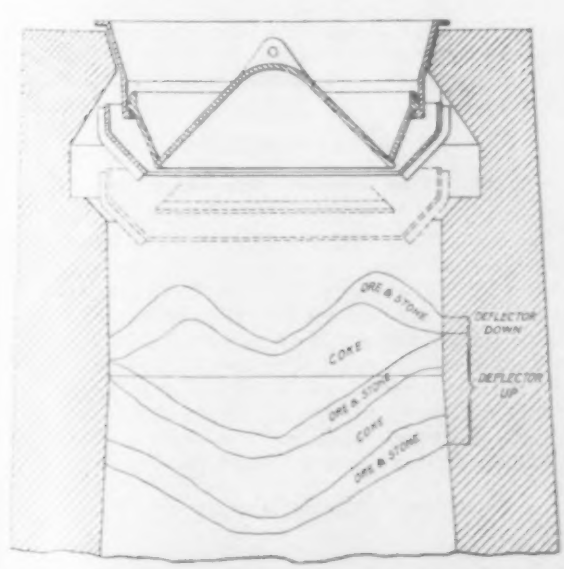
Below is a comparative statement showing the results obtained on a furnace with a Killeen distributing ring and the same furnace without the distributor but with a 12-ft. bell—11 months' operation in both cases:

	Tons per Day	Lb. Coke per Ton Iron
With Killeen distributor.....	497.7	2,240
Without Killeen distributor....	531.1	2,029

This type of ring served one good purpose in that it protected the stock line of the furnace, but operating conditions were such that we could not afford to pay the price for this protection.

The MacDonald distributing ring, also shown in an accompanying drawing, differs from the Killeen in that the large bell is of standard diameter, the same as would be used without the distributor, and the distributing ring is raised or lowered as desired. The usual method of operating this type of top is to keep the distributor in the upper position clear of any materials as it leaves the bell for three or more charges. The distributor is then lowered and the suceeding charge is dropped into the furnace.

Having a movable distributor, the operator can throw the fines toward the wall from the large bell, the distributor being in the upper position and out of the path of the raw material; or, by lowering the distributor, the operator can throw the major portion of the coke to the center of the furnace, with the fines and most of the ore away from the wall.



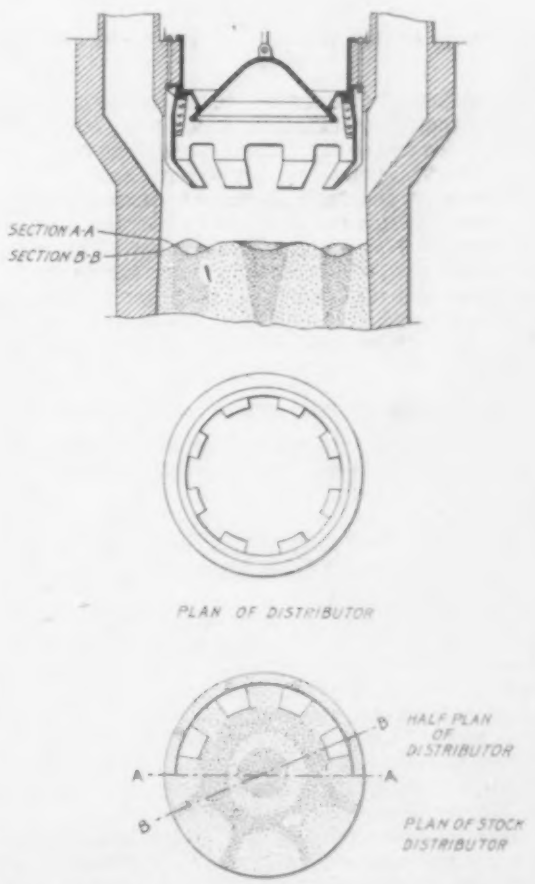
The Movable MacDonald Distributing Ring and What It Secures Within the Furnace

One of the latest developments in distributing rings below the large bell is the one designed by E. E. Slick, as shown in one of the cuts. This ring is permanently set in the furnace top and combines some of the features of the Killeen and MacDonald rings, with the further and radical development that the lower portion of the ring consists of a number of fingers equally spaced, with the lower end projecting inwardly.

As the material leaves the large bell, those portions which impinge upon the fingers are deflected toward the center of the furnace, the portions which pass between the fingers continue in their travel outwardly toward the wall of the furnace, and that which impinges against the upper portion of the straight ring or skirt drops more or less vertically.

In this way the charge is deposited in the furnace so as to form a number of vertical columns of finer material. These columns are formed by the separation of the coarser portions of the charge which roll down from each of the small mounds formed on the surface at the stock line.

This design permits of a relatively uniform ascent of the gas, due to the lines of greater porosity surrounding the denser columns of fine materials, and also tends to give a more intimate mixture of the raw materials over the entire area with a certain percentage of fines close to the walls, which latter condition we have found is so necessary for our operation. The use of the Slick distributing ring has shown some meritorious results. As such excellent work is being done on furnaces without a distributing device below the large bell, their necessity is not apparent, at least under our present conditions.



The Distributor Designed by E. E. Slick and What It Does

ECONOMIC IMPORTANCE OF IMPROVED BLAST FURNACE OPERATION

The estimated amount of iron ore to be brought down from the Lake Superior region this year reaches the enormous figure of 66,000,000 gross tons, practically all of which is to be used for the production of pig iron. If by more perfect distribution of our raw materials in the blast furnace and with other improvements that

could be effected in many furnaces, an increase of only ½ per cent. of the metallic yield should be effected over this entire quantity of Lake ore, it would mean that 610,000 tons of ore could be reserved annually for the future.

As the more perfect distribution reduces our metallic loss, so does it reduce the coke consumption, as they go hand in hand; and if we could reduce our coke consumption for the smelting of this quantity of ore by 5 per cent., we would save 1,750,000 tons of coke, with 2,500,000 tons of coal left in the mines for future generations to use.

The thought of effecting an increase of ½ per cent. in yield and 100 lb. of coke per ton seems small when we talk of them in our every day practice, but in the aggregate they amount to large figures. If we convert the 610,000 tons of ore and the 1,750,000 tons of coke into dollars, and reconvert this money into labor, where the larger part of the cost originated, we can appreciate not only the loss of the raw material, but the enormous economic loss represented by labor.

Discussions

BY ARTHUR J. BOYNTON

Superintendent blast furnaces, Lorain works, National Tube Company.

The matter of distribution about the main bell has been complicated by influences which are generally appreciated. To one so far little reference has been made. An insufficient number or insufficient area of downcomers has been generally supposed to cause enough loss of fine coke and fine ore at a point under the downcomers to cause hot working at these points. The remedy for this condition, which consists in increasing the area of the furnace at the level of the offtakes and increasing their number and area and their angle with the horizontal, is well understood and has been applied to many furnaces.

BLAST TEMPERATURES AND WIND DISTRIBUTION

There exists also the problem of what is called wind distribution. It is apparently little affected by the drop in pressure around the bustle pipe. I have attached a differential gauge to the bustle pipe of a furnace immediately over the blast inlet and on the side opposite and have never found more than 0.2 in. of mercury difference in the static pressure.

Experiments which we have recently made with regard to the difference in temperature of blast in the tuyere stock immediately under the blast inlet and that opposite, in three different furnaces whose stoves are supplied with washed gas, showed a practically constant drop of nearly 50 deg. Fahr. from one side to the other. Just what the effect of such a constant difference in temperature may be, is, like everything that goes on in the blast furnace, a matter of speculation.

I believe, however, that the hotter blast tends to premature melting, and to increased wind on the side next the blast inlet. If this difference happens to aggravate an error in stock distribution the contour of the stock column is very possibly affected so that the hot side is low, with a tendency for coarse coke to remain close to the hot side, thus making the effect cumulative, in which case there will be very one-sided working and rapid destruction of the lining. The remedy for this condition lies in the use of insulating brick, for which there is apparently a more important reason here than at the hot blast main or stoves, or possibly in the use of a tapered bustle pipe, which will decrease the surface of the pipe relatively to the amount of air flowing. These pipes were formerly tapered by dust in the pipe, and the clean pipe following the advent of washed gas has doubtless increased the radiation, which high blast temperature also increases.

When all these variables existed to a greater degree than they now do, there grew up certain rules for locating downcomers, hot blast inlets, tapping holes and skip hoists with reference to each other about the circumference of the furnace. These rules were formulated by men of experience and good judgment, and were no doubt correct for the conditions as they existed locally and temporarily. They would not, however, apply where one variable was changed, consciously or unconsciously, and much grief was occasioned by borrowing a rule without sufficient understanding of the reasons for its existence.

The study of means of distribution can not be carried to any very satisfactory conclusion by means of small scale models. Certain of the grosser errors can be identified and corrected by this means, but a full scale model is required for anything approaching accuracy.

McKEE TOP AT LORAIN WORKS

The McKee distributor has been applied at the Lorain Works. The installation includes a ball race at the top of the small bell tube and a magnetic control for automatic rotation. This control is located on the ground level, usually in the skip engine house, can be built for any number of points of distribution and skip loads per charge, and as long as this cycle is followed, is entirely automatic. By throwing out the automatic control, hand control may be substituted. Rotation is started by contact made by a nut on a lead screw which revolves with the skip engine, contact being made when the engine reaches the end of its travel.

To the much discussed question as to whether it is necessary and advisable to complicate furnace construction and operation by the installation of revolving tops, there are two answers: first, that mechanical and electrical progress, not only in building the rotating mechanism, but also in the furnace itself, have made the complication almost inappreciably small; and second, that modern progress is not satisfied with any distribution short of the very best obtainable. The investigator who has gone through the costly and cumbersome experiments necessary to approximately good distribution in a stationary top is forced to admit that his limit is far from perfection, that his good distribution becomes poor distribution by a change from dry stock to wet, and that the variables due to weather and condition of stock which are most hopeless with a stationary top, are those which rotation most easily corrects.

A dash pot in the system may be set to allow any required number of seconds to elapse between the completion of travel of the skip and the beginning of rotation, in order to clear the skip car of material before rotation starts. The skip car is free to run as in ordinary operation. Rotation is stopped by a limit switch geared to the drive on the top of the furnace, and by a magnetic brake on the motor shaft. Regulation of angle of revolution is practically correct. Five wires from the ground level to the top are required, three to the motor and two to the limit switch. The outside wiring is therefore very simple. The amount of attention required is that usually given to such switchboards, repairs are light and interruptions to service infrequent and of short duration. The drive and rotating parts require no attention except oiling. The ball races are arranged to clear themselves of dirt, and where cut steel gears are employed the wear is very slight. In our experience, therefore, the operation of the top presents no difficulties.

BY J. C. BARRETT

Superintendent blast furnaces, Ohio works, Carnegie Steel Company, Youngstown

We use a McDonald distributor at the Ohio Works, Carnegie Steel Company. Our method has always been to use a large ore charge, 28,000 to 32,000 lb. The coke, ore and stone are deposited on the big bell as follows: 2 skips coke, 1 skip ore, 2 skips coke, 1 skip ore, 1 skip stone; 7 in all, lowered into the furnace as a mixed charge. The general use of the distributor is: two charges of stock with the distributor up, discharging against the furnace wall, and then one charge with the distributor down deflecting toward the center.

USE OF M'DONALD DISTRIBUTOR

Our experience is that coke breeze and limestone dust are detrimental to the furnace operations and by the use of the distributor we are enabled to throw, in the two up and one down operation of the distributor, two

of the limestone skips to the center, making the charge 2 stone, 3 coke, 2 ore, and the two charges going on the side, making one charge 1 stone, 4 coke, 2 ore and the other charge no stone, 5 coke, 2 ore. This thins out the fines on the side of the furnace and allows more gas to get to the side.

Another beneficial effect is possible when the furnace is clogged up and gives the appearance of being built up on the bosh. By charging the furnace with the distributor up for one charge and then down for one charge, it is possible to put in the center the charge made up of 2 stone, 3 coke and 2 ore and to the side of the furnace a charge made up of no stone, 5 coke and 2 ore. In thus charging for a period one puts all of the stone in the center and extra coke to the side.

Five of our six furnaces are equipped with a McDonald distributor, and I hereby submit the operation of all furnaces since the last blow in or since the last repair, until April 1, 1916. No. 3 furnace is the one not equipped with a distributor.

Performance of Blast Furnaces, Ohio Works, Carnegie Steel Company.

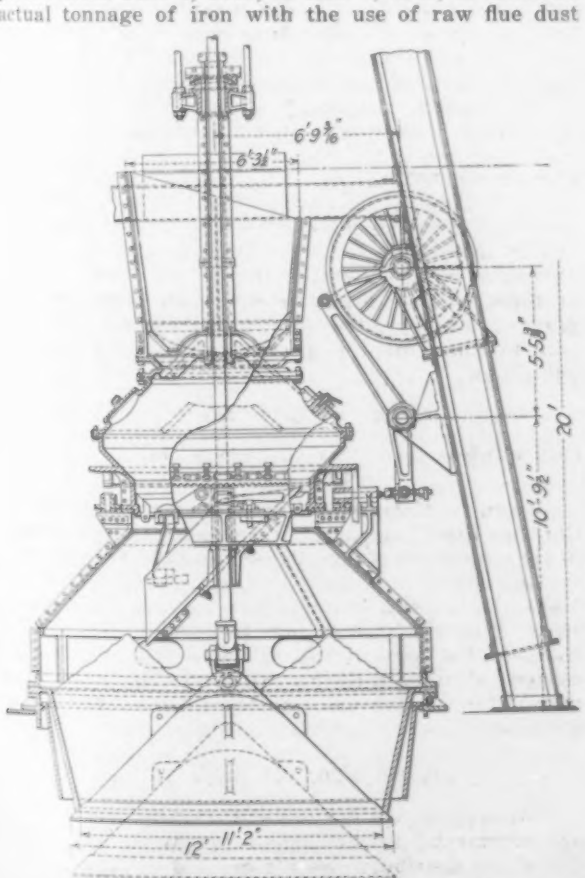
Length of service—No. 1, 1 yr. 22 da.; No. 2, 1 yr. 7 mo. 9 da.; No. 3, 1 yr. 10 mo. 26 da.; No. 4, 1 yr. 2 mo.; No. 5, 1 yr. 2 mo. 6 da.; No. 6, 2 yr. 2 mo.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Coke, per ton....	1,907	1,982	2,236	2,198	2,104	2,143
Av. tons per day.	570	544	485	523	529	497

No. 3 blown out to repair stock line 1-14-16.
This includes coke dust which averages 50 lb. per ton of iron and does not go into the furnace.

This distributor has served a useful purpose in our operations by distributing the stock in a way that gives economy. It is used on normal or standard sized bells and is flexible to all kinds of filling. Two features must not be overlooked, one the use of water on the stock by which it is possible to keep the gas temperature about 300 deg. In any method of filling if the water is omitted, it will allow the temperature to go high and vitiate any uniform distribution by allowing the excess dust to blow over. The other feature is a perfect condition of the stock line, which if lost upsets all other distributions and economies.

With a good uniform distribution of the stock when placed on the big bell and the proper deflection of the stock in the furnace (a low temperature of the top gases and a good stock line), it was possible in the period from Jan. 1, 1909, to Jan. 1, 1916, to make an actual tonnage of iron with the use of raw flue dust



Crockard-Brown Blast-Furnace Top

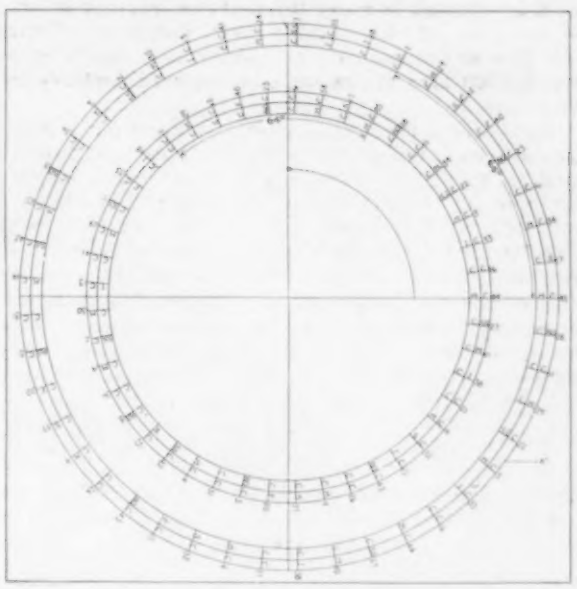


Chart for Charging Furnace: M, Muscoda ore; F, fossil ore; I, Ishkooda ore; BO, brown ore; SS, dolomite and converter slag; S, dolomite, and C, coke

(881,670 tons of raw dust used and 529,779 tons produced) of 6,008,556 tons, whereas the available tonnage of iron without the use of dust was 5,959,231 tons, a gain of 49,325 tons. This showing looks like a good step toward conservation of materials and labor.

BY K. L. LANDGREBE

Superintendent blast furnaces, Tennessee Coal, Iron & Railroad Company, Ensley, Ala.

The development of the present stage of the distributing top of the Ensley blast furnaces started with the Brown top in which the method of sealing the gas when the large bell was lowered was by means of a flap-door closing the end of the spout in all positions except the closed position of the bell. Now there is above the distributor spout a small bell. This, besides serving as a gas seal, brings to rest the charge from the skip cars before it is passed through the spout and on to the big bell The final stage of the top is shown in the accompanying illustration. The revolving portion of the top has been extended up to the little bell seat and the little bell is supported on a ball race.

RESULTS WITH THE CROCKARD-BROWN TOP

Furnaces Nos. 2 and 3 at Ensley were the first furnaces to be equipped with this modified Brown top. This arrangement was patented by F. H. Crockard, vice-president of our company. This type of top has given remarkable results, as can be seen from the following figures. No. 3 furnace was put in blast July 20, 1909, and produced to May 1, 1916, 912,735 tons of basic and foundry iron. This furnace has not shown any signs of a hot spot or any indications that the lining above the mantle is any the worse and outside of a weak bosh looks good for some time to come. No. 2 furnace was put in blast Feb. 5, 1910, and up to May 1, 1916, produced 883,443 tons of basic and foundry iron. This furnace also looks good for some time to come, and we are in hopes that it will establish a new record for tonnage made on a lining, notwithstanding the fact that our ore mixtures only have a theoretical yield of approximately 39 per cent.

REMARKABLE FURNACE PERFORMANCE

We believe these total tonnages of raw materials charged (3,842,362 tons in the one case and 3,695,754 tons in the other), are as great, if not greater, than any tonnages ever charged into a blast furnace in this country during a campaign. The record of these two furnaces has been remarkable, and I do not know of

(*Continued on page* 1370)

POWER IN ROLLING STEEL

Requirements in Rolling Square Sections—An Investigation of Published Data

BY CHARLES M. SAMES*

Some months ago the writer desired to obtain information on the power required to roll rectangular steel sections (*i. e.*, the "pure roll work," or that expended solely in deforming the heated metal) for application to a particular problem. As nothing on the subject could be found in the engineering reference works and treatises at hand, recourse was had to the results of the elaborate series of tests carried out in Germany some years ago by Dr. Ing. J. Puppe, and published in a volume entitled "Versuche zur Ermittlung des Kraftbedarfs an Walzwerken" (Düsseldorf, 1909), an English translation of which was brought out a year later under the title "Experimental Investigation on the Power Required to Drive Rolling Mills" (C. Griffin & Co., Ltd., London). Later work of Dr. Puppe, as published in *Stahl und Eisen*, was also consulted, as well as the data given by Barton R. Shower in *Proc. A. I. E. E.*, March 12, 1909.

About 50 of these tables examined deal wholly or in part with rolling through rectangular passes, and of these 35—which are fairly representative of all, barring a few abnormal exceptions—have been studied. They have to do with basic Bessemer and open-hearth steel ingots weighing from 260 to 8200 lb., with sections ranging from 20 to 320 sq. in. with rolling temperatures of from 1960 to 2300 deg. Fahr., with initial tensile strength (cold metal) of from 56,000 to 112,000 lb. per sq. in., and with reductions of area per pass of from 5 to 25 per cent.

Several methods of analyzing the data were essayed, but the most consistent results were obtained by the use of a formula proposed by Victor E. Edwards before the Engineers' Society of Western Pennsylvania in 1913. This formula, slightly transformed, is:

$$P = \frac{C\,W \log (A_1/A_2)\,\sqrt{D/T}}{t}$$

in which P is the mean horsepower required for the pass in question; W = weight of ingot (or billet), lb.; $A_1(A_2)$ = sectional area of ingot before (after) rolling; D = external or pitch diameter of rolls, in.; T = thickness of ingot when leaving rolls, in.; t = duration of pass, seconds; and C is a coefficient.

In the 34 tables from Dr. Puppe's work (over 250 separate tests) a mean value of 12 was found for C. In 25 of these tables C ranged from 10.3 to 12.5, and the extreme values for all of the tables were 10 and 16. The first nine passes of Mr. Shover's table (all of the rectangular passes) give $C = 12.3$, which is well in agreement with the mean value of 12 obtained from Dr. Puppe's tests.

That the power required to roll steel decreases with an increase in the rolling temperature is shown by all of Dr. Puppe's results where the same quality of metal was used in two or more series of tests, but the exact influence of the mechanical properties of the metal rolled is not apparent from a study of the data accompanying the tables; the latter show, however, that the power required does not vary in the order of the tensile strengths of the cold ingots.

For preliminary calculation, then, C may be taken as 12, and assuming that this value is constant for each pass, and that the temperature at the first pass is around 2200 deg. Fahr., reasonably approximate results should be obtained. For example, let it be required to determine the power necessary to reduce a 16 × 16-in. ingot 60 in. in length (weight W = 4163 lb.) to 8¾ × 8 in. in six passes, the pitch diameter of the roll being 40 in. and its speed 60 r.p.m. Table I gives the results of the necessary calculations for the case where the percentage reductions for the several passes are roughly equal.

TABLE I

No. of pass	1	2	3	4	5	6
Sectional area, sq. in.	204	165.75	133.25	107.63	84	70
Width x thickness, in.	16 x 12.75	12.75 x 13	13 x 10.25	10.25 x 10.5	10.5 x 8	8 x 8.75
Per cent reduction	20.31	18.75	19.61	19.23	21.95	16.67
Log (A_1/A_2)	0.09861	0.09018	0.09479	0.09275	0.10763	0.07918
$\sqrt{D/T}$	1.462	1.441	1.704	1.676	2.0	1.89
Hp.-sec. $(=P \times t)$*	7,202	6,492	7,520	7,766	10,753	7,476
Length of ingot, in.	75.29	92.67	115.27	142.72	182.86	219.43
Duration of pass, sec.	0.88	1.093	1.233	1.540	1.819	2.235
Horsepower $(=P)$	8,188	5,942	6,542	5,043	5,912	3,345

*Total hp.-sec. for all six passes = 47,210.

It is seen from this table that the drafts on the motive power range from 3345 hp. to 8188 hp.; but by a little manipulation of the percentage reductions—in which they are altered to an ascending scale—it is possible roughly to equalize these drafts, as shown in Table II, where the variation is reduced to the range 5354 hp.—6083 hp.

TABLE II

No. of pass	1	2	3	4	5	6
Sectional area, sq. in.	216.8	181.57	149	119	93.625	70
Width x thickness, in.	16 x 13.55	13.55 x 13.4	13.4 x 11.12	11.12 x 10.7	10.7 x 8.75	8.75 x 8
Per cent reduction	15.31	16.25	17.94	20.13	21.32	25.23
Log (A_1/A_2)	0.07218	0.07701	0.08586	0.09764	0.10415	0.1263
$\sqrt{D/T}$	1.396	1.409	1.612	1.655	1.89	2.0
Hp.-sec. $(=P \times t)$*	5,038	5,420	6,912	8,072	9,833	12,620
Length of ingot, in.	70.85	84.6	103.09	129.07	164.06	219.43
Duration of pass, sec.	0.853	1.012	1.136	1.402	1.671	2.183
Horsepower $(=P)$	5,910	5,354	6,083	5,756	5,884	5,781

*Total hp.-sec. for all six passes = 17,985.

It is also seen that the total work in horsepower-seconds is practically the same for the two tables, although the orders and magnitudes of the percentage reductions differ considerably. The work expended also increases somewhat with a decrease in the number of passes employed in effecting the total reduction, or, what is the same thing, with an increase in the average percentage of reduction per pass, and vice versa. For example, with calculations similar to those in Table II, but for four passes, horsepower-seconds = 49,690, an increase of 3.8 per cent; for eight passes, horsepower-seconds = 47,000, a decrease of 1.8 per cent; and for twelve passes, horsepower-seconds = 46,120, a decrease of 3.7 per cent.

*Mechanical engineer, 542 Bramhall Avenue, Jersey City, N. J.

Canadian Car & Foundry Report

The Canadian Car & Foundry Company, whose operations in securing shell contracts caused such a sensation last year, has issued its annual report for the year ended Sept. 30, 1915. It shows a deficit on the year's operations of $558,472, against a surplus for the previous fiscal year of $65,808. This poor showing is due to the fact that the depression in Canada had prevailed for almost the whole of the fiscal year. The earnings from munition orders did not begin to become effective until the last month or two of the fiscal year. The report states that these orders should be the chief factor in the company's operations for the fiscal year which will end Sept. 30, 1916. The following extracts are made from the remarks accompanying the financial statement:

"The continued depression in the railroad equipment industry affected the operations of the Canadian Steel Foundries and the Pratt & Letchworth Company, subsidiary companies, and the work was conducted at a loss. Canadian Steel Foundries is now engaged largely in producing shells and its operations for the fiscal year 1916 should show satisfactory results. The Rhodes-Curry Company, another subsidiary, had a fairly successful year.

"After the outbreak of the war in 1914, manufacturing requirements became so limited that it was necessary to seek foreign business. With this object in view the president visited London in November, 1914, and was followed by W. W. Butler, senior vice-president, who opened offices in that city. In the meantime F. H. Clergue visited Petrograd with authority to seek business for the company. Mr. Butler joined Mr. Clergue there and arrangements were completed for two contracts with the Chief Artillery Board of the Imperial Russian Government for the supply of 5,000,000 shells. The contract included the completed shells.

"As the British War Office had by this time begun to place large munition orders in Canada it was decided to be in the best interests of the Allies to sub-let the many component parts of the shells in the United States. This was done, although some of it was done in Canada.

"The terms of the contracts authorized 12½ per cent advance from the Russian Government upon the surety bonds acceptable by the government. Such acceptable surety practically exhausted the available resources of the surety bond market, and it became necessary for the company to make large advances on its own account. Even with such assistance as the company was able to give, the funds available were not found adequate.

"There were various reasons for the company's need of large working capital. The company believed that prices of the metals used in making shells would advance rapidly. Therefore at the outset it contracted for many millions of dollars' worth of raw material and component parts of shells. This was good business, as now raw material is being purchased at an advance of 50 to 300 per cent over the price the company paid. Other financial necessities were caused by having to employ many other manufacturers to fill sub-contracts. These numbered about 100 and to most of these advances had to be made, not only for purchased material, but in many cases to enable them to erect buildings and to purchase and install the necessary machinery. Owing to inexperience their deliveries and output were very inaccurate and disappointing.

"Still another call for the need of additional capital was brought about by a change that took place in the administration of the Artillery Board of the Imperial Russian Government. The new board would not pay for shells until they were complete, while the old board had agreed to pay for component parts on delivery."

Raw copper imported into France in 1915 is given as 111,400 metric tons, against 78,522 tons in 1914. The imports last year were the largest recorded, the previous record being 94,860 tons in 1913. Tin imports were 9003 tons in 1915, against 7216 tons in 1914, with zinc at 36,125 tons in 1915 and 30,651 tons in 1914. Almost all the copper came from the United States and all the tin from Great Britain.

New Bessemer Plant Near Chicago

CHICAGO, ILL., May 31, 1916.—(*By Telegraph*).—The Mark Mfg. Company, manufacturer of wrought pipe and oil-well casing, with plants at Evanston, Ill., and Zanesville, Ohio, has awarded contracts for the erection of a Bessemer steel plant to be located on a site of 370 acres at Indiana Harbor, Ind., near Chicago. The property has a frontage of 4000 ft. on Lake Michigan and more than a mile along the Government ship canal. With these facilities for water transportation and immediate rail connections with the New York Central, Pennsylvania and Baltimore & Ohio railroads, the site is most favorably located for transportation. The plant will include two Bessemer converters, each of 15 tons capacity, and blooming, billet, skelp and pipe mills, all electrically driven, the current to be supplied from an electric power station to be included in the plant. The Mark Mfg. Company is associated in the recent acquirement of the Iroquois Iron Company, and the production of the two largest blast furnaces of that plant will be taken for the new works under a contract running for a period of years. The plans for the new steel works provide for blast furnaces and coke ovens, and arrangements have been made for ore supply, insuring a completely self-contained steel works unit. The Mark Mfg. Company began the manufacture of water well supplies in 1888 and built its Evanston pipe mill in 1901. The same organization will continue to control the operations of the company in its steel works expansion.

A Bureau of Research in Sales Methods

About thirty of the strongest business concerns are co-operating with the Carnegie Institute of Technology in Pittsburgh in founding and maintaining a bureau of research in sales methods. Plans have been made to send Prof. Walter Dill Scott, of the Northwestern University, to Pittsburgh, and he will be assisted in his work by Dr. W. V. Bingham and J. D. Minor, of the Carnegie Institute of Technology. Dr. Scott is a leading investigator of salesmanship and advertising, and is the author of several text books on these subjects. Dr. A. A. Hammerschlag, of the Carnegie Institute of Technolgy, in speaking of the project, said: "We will carry forward actual experiments in the selection and training of salesmen, in co-operation with sales managers and employment managers, enough of whom have already placed their sales organizations and records at the service of the bureau to insure the necessary data for checking the results of the studies made."

The idea, which is the first of its kind to be put into operation in the country, was conceived by Edward A. Woods, of the Edward A. Woods Agency, Pittsburgh. The executive committee consists of Mr. Woods; Dr. W. V. Bingham, executive secretary, N. A. Hawkins, Ford Motor Company; Wallace H. Rowe, Pittsburgh Steel Company, and S. L. Nicholson, Westinghouse Electric & Mfg. Company.

A Machinable Acid-Proof Iron

A cast iron, claimed to be easily machinable and acid-proof and known as Corrosiron, is made by the Pacific Foundry Company, San Francisco. It is high in silicon and can be cast in difficult shapes. Many pieces have been made with bars of iron or steel cast within the metal, giving added strength. Because the alloy is inclined to be brittle it must be handled carefully. Its strength is reported to be half that of cast iron, a bar 1 x 2 x 24 in. giving a transverse strength of 1200 lb. with a deflection of about 0.14 to 0.18 in. The fracture is described as similar to that of ice, with long, flat crystals but not granular. The shrinkage is 3/16 in. to the foot, about that of brass. Flat surfaces are avoided in designing, corners are rounded and the sections of metal are kept as even as possible. The greatest loss in some corrosion tests was 0.58 per cent in 17 days' immersion in concentrated hydrochloric acid, with the smallest 0.0015 per cent in 7 days' immersion in various strengths of nitric acid.

ESTABLISHED 1855

THE IRON AGE

EDITORS:
A. I. FINDLEY
GEO. W. COPE W. W. MACON
CHARLES S. BAUR, *Advertising Manager*

Published Every Thursday by the DAVID WILLIAMS CO., 239 West Thirty-ninth Street, New York

W. H. Taylor, *Pres. and Treas.* Charles G. Phillips, *Vice-Pres.* Fritz J. Frank, *Secretary* M. C. Robbins, *Gen. Mgr.*

BRANCH OFFICES—Chicago: Otis Building. Pittsburgh: Park Building. Boston: Equitable Building. Philadelphia: Real Estate Trust Building. Cleveland: New England Building. Cincinnati: Mercantile Library Building.

Subscription Price: United States and Mexico, $5.00 per year; single copy, 20 cents; to Canada, $7.50 per year; to other foreign countries, $10.00 per year. Entered at the New York Post Office as Second-class Mail Matter.

Our Foreign Trade

February, March and April all made new records in one way or another in our foreign trade. February showed the curious combination of record high imports, record high exports and record high favorable balance. March did not do altogether as well, showing new high records for both imports and exports, but as the increase in imports was large and the increase in exports small the trade balance decreased. Then came April with an increase of over $4,000,000 in imports, making a fresh record for high imports, but with a decrease of over $5,000,000 in exports, so that the favorable balance fell off very materially.

The record balance, made in February, was $209,056,001, while the April balance was $186,542,616. While this was a very material decrease, comparison with 1915 makes a very satisfactory showing, since the monthly average in 1915 was $147,406,973, the year's balance being $1,768,883,677. The balance accumulated in the first four months of this year is $738,000,000.

It is a question, on the whole, whether the unseen balance, always against us, is larger or smaller now than the average of preceding years. Allowance for the unseen balance must always be made in estimates of the extent to which the country is being made prosperous by a favorable balance in the merchandise trade. It has never been possible to compute the unseen balance by adding up the various elements entering into it, on the debit and credit side, and a closer approximation can be made by considering the merchandise balances over a long series of years, for the merchandise and the unseen balances cannot in the long run come very far from balancing.

An estimate of $600,000,000 a year would probably not be very far out for the unseen balance since the war started. At that time there was a debit against us, though American authorities never admitted it was as large as Sir George Paisch estimated. Allowing for this, it would appear that up to the beginning of this year our trade balance had exceeded the normal required to settle the unseen balance, by about a billion dollars. In the first four months of this year there was the favorable merchandise balance noted above of $738,000,000, and deducting $200,000,000 for settlement of the unseen balance in the four months there would be left $338,000,000 to be added to the billion already accumulated; and even with the reduced rate of April there should be added to this $130,000,000 or $140,000,000 a month.

Of course, there is no accumulation existing in this form. Much if not all has been liquidated in extraordinary ways, as by the Anglo-French external loan placed in this country. The significance of the figures is in their approximate measure of the extent to which the country has grown richer. The improved position is largely responsible for the present industrial activity, the "good times" in other words. The prosperity is not wholly due to the profits obtained directly upon exports, but is due in large part to business in general being stimulated.

That such is the case may be discerned to an extent by scrutiny of the condition of the steel trade itself. While there has been much in evidence a disposition to credit the steel trade's prosperity directly to "war orders," it has been observed month by month that the steel activity is more and more due to strictly domestic buying. While the proportion of steel exported directly or indirectly has been running generally at between 20 and 25 per cent of the production, probably never in a single month more than 25 per cent, this proportion is not much larger than that attained in 1912 and 1913. There is this important observation to be added, that while war steel orders were placed for quite forward delivery, particularly last fall, the proportion of export business on the books of steel producers at present is probably materially under 20 per cent of the total business on books. The trend in steel, therefore, continues to be toward a still larger proportion of domestic business. The wealth being added to the country month by month is not temporary, but a permanent addition, which should keep the country prosperous in future, provided it is not dissipated.

That the accumulation may easily be dissipated, however, is well recognized. There are various ways. The rich may spend too much money in luxuries from abroad. Workmen may not be willing to do an honest day's work for pay in some reasonable proportion to that given abroad. The country's resources may be drained by the absence of a reasonable protective tariff. Preparedness for peace consists largely in protection of the wealth that has been and is being acquired, and the two most impor-

tant requisites are a reasonable condition as to wage rates (and performance for the wage) and an adequate protective tariff.

Concerning Co-operation

Vice-Chairman Hurley of the Federal Trade Commission showed again, in his address at the American Iron and Steel Institute's meeting last week, why the business men of the country have taken heart at the influence of such a man in the councils of that important arm of the Government. In addressing associations of manufacturers in the past year he has consistently dealt with conditions and not with theories. He has been a conspicuous exemplar of what a well-equipped business man can do for the public good in a place of high responsibility.

Mr. Hurley said a good deal to the steel makers about co-operation. That word has been quite in the background at Institute meetings since the day of the Gary dinners. But Mr. Hurley used it fearlessly. It was a part of his subject, in fact—"Co-operation and Efficiency in Developing Our Foreign Trade." He said a great deal about the syndicates and cartels in the steel trade of European countries—pointed to them, indeed, as models:

> We can learn many things which will assist us in developing foreign trade, from the organization and efficiency of the iron and steel industry in the great industrial countries of Europe. In Europe this industry illustrates the effectiveness of co-operation, first between business men, second between business men and government. I feel that we should study its methods both because it is one of our most formidable competitors in foreign markets and because it will suggest to us methods for meeting this competition successfully.

When, after describing in detail the operation of these European steel syndicates, telling how they "pooled their forces," or "combined," or "had an agreement," or "organized and co-operated," Mr. Hurley came to the lesson, he pointed out that since these European syndicates were so successful in export trade, there must be in this country co-operation for the development of our foreign trade —co-operation between business men and between them and the Government. Then followed what the Federal Trade Commission some time ago announced, that it believes Congress never intended the anti-trust act to "prevent Americans from co-operating in export trade for the purpose of competing effectively with foreigners, where such co-operation does not restrain trade within the United States and where no attempt is made to hinder American competitors from securing their due share of the trade."

It was well known to Mr. Hurley's hearers, as it was well known to him, that the success of the steel syndicates of Europe, which he holds up as patterns, is due largely to their ability to maintain in their domestic markets higher prices than those at which they sell for export. Their domestic co-operation is far more important to them than their co-operation in exports; in fact, the former is indispensable to the latter. They would consider government permission or even encouragement of combination for exports a doubtful gift if with it came government prohibition of co-operation in the home trade. There is no particular generosity in allowing a number of competing manufacturers to enter into an agreement to cut their mill price on a shipment of steel that is to pass the mill of a foreign competitor in the last fraction of its long journey to the consumer. The real problem is how to make sure of a profit from the home trade which their plants were built to supply.

If that is the standpoint of the European syndicate member what is the standpoint of an American steel manufacturer—a so-called independent, let us say? He might gain something by combining with one or more competitors on exports, particularly where some products were not common to all, thus dividing the expense of foreign agencies and securing as great a variety of products as the Steel Corporation offers. Therefore he should favor the Federal Trade Commission's recommendation of permissive legislation as a first step. But by itself that will not come to a great deal. We do not say that co-operation in the domestic steel trade, to the extent of price regulation, and possibly with the oversight of the Federal Trade Commission, is either possible or desirable. That is a large question, and the industry has changed much in its competitive alignment since the Gary co-operation. But when Commissioner Hurley tells us, and with good reason, that a study of the methods of the European steel syndicate "will suggest to us methods of meeting this competition successfully," the inevitable destination of his logic is some form of regulation of prices and output at home.

A New Epoch in Electric Steel

The decision of the United States Steel Corporation to manufacture electric steel on a large scale marks a new stage in the development of this branch of the steel industry. The installation and operation of three 20-ton Heroult furnaces, in addition to the two 15-ton furnaces it already has, will make the corporation the largest producer of electric furnace steel in the world. The undertaking also more emphatically puts the stamp of approval upon the practicability and efficiency of the electric furnace as a steel melting and refining medium.

A feature of the Steel Corporation's enterprise will be the use of the electric furnace largely in conjunction with the open-hearth and duplex systems as a direct and quick refining agent for hot metal. Previous to 1915 the use of the electric furnace in the United States was confined closely to making steel castings from cold stock. As the war progressed, the demand for high speed and munition steels opened up a new field and the expansion in 1915 in the manufacture of such steels in the electric furnace was astonishingly rapid. In recent months plans have broadened for the conversion of electric furnace steel into seamless tubes and other products. Now the Steel Corporation is to convert such steel on a large scale into high grade finished and unfinished alloy steels.

This large increase in electric furnace capacity will unquestionably put this country in the front rank in point of production. While the review of the world's electric steel industry, compiled by THE

IRON AGE and published Jan. 6, 1916, showed that this country then led in the number of electric furnaces operating or contracted for, later announcements bring the total up from 73 on Jan. 1 to over 100 at the present time, an increase in five months of about 40 per cent. Though Germany appears to have made more electric steel in 1915 than any other country, the United States promises to lead the world for some time to come, with a total capacity probably exceeding 1,000,000 tons per year.

The War and American Patents

The present situation regarding foreign patents as it affects American inventors and manufacturers is somewhat complex, and the end of the war will not readily clarify matters. The Commissioner of Patents at Washington has created a "war measure" which helps to some extent, and the belligerent nations are doing their best to safeguard the rights of those in neutral countries to whom they have issued patents and those who are seeking protection for their inventions. Great Britain has laid aside the compulsory working section of her law for a period which will end six months after peace has been declared. Germany has adopted a similar policy. The time of payment of taxes on outstanding patents has been extended several times, and it is understood that inability to pay these fees will be attributed to war conditions. The German compulsory working act does not affect American patents; they are exempt under a special treaty. The provision in the French law is easily complied with; all that is required is periodic advertising. Canada is willing to accept war excuses from delinquents. Austria, Italy, Russia and other nations are believed to be prepared to accept back taxes later.

Most foreign nations, under their laws and under treaties with the United States, demand that application for a patent be made before publication of the invention in America. Failure to live up to this provision withdraws all protection. In such a case, even if the patent has been issued, it may be infringed in any of these countries without hope of redress on the part of the owner. It was because of these conditions that the Commissioner of Patents framed his war measure.

The usual practice has been, where an invention is to be patented in other countries as well as at home, to complete the search for foreign interference before filing applications abroad. The United States requires the payment of the fee, which precedes the issuance of the patent, within six months of the date of the notification of allowance. It was the practice to issue the patent and make publication four or five weeks later, and before the war this period was ample for the sending of applications to foreign countries and filing them there.

Now the patent attorney, in looking after the interests of his clients, finds it expedient to send the applications abroad as soon as it is known that the Patent Office at Washington has acted favorably, and, withholding the fee here, let the United States patent issue later. Then, should delay occur in the receipt of word from the foreign countries that the papers had been received at all their destinations, and the six months limit under our law be near expiration, the fee is paid and the Patent Office at Washington puts its war measure into effect. That is, it extends the time of the issuance of the patent and of publication for any period asked for up to three months. Thus the inventor has practically nine months in which to get his foreign patents started, and is presumably secure against the danger of a misfire which might prove costly.

Another effect of the war may be complications as to existing patents which will not come to light until later, in the violation of American patent rights by the manufacturers of belligerent countries, abetted by their governments. Naturally a nation carrying on a crucial war would not be scrupulous about such minor concerns as patent infringements, and these, if they existed, would be hidden in plants guarded against inspection. Government protection of rights to a rifle sight, an improvement on a gun carriage or a torpedo, a process for treating steel, an automatic machine for making munitions, or a method of reclaiming waste products, might be cast aside without the slightest formality. But with the return of peace, governments and individuals may be expected to make amends, possibly on a royalty basis.

Complications may be looked for from the action of belligerent nations against inventors in enemy countries. For example, France has canceled patents granted to citizens of Germany. So far as the patent authorities in this country have learned Germany has taken no retaliatory measures as yet. Conditions such as these can have no more than an indirect effect in the United States, but as between foreign manufacturers the results may prove important.

The advocates of a compulsory working section in the patent laws of the United States see in the future a need more pressing than ever for the adoption of the principle. The view is not new that low-priced European products will pour into this country after the war in the effort to establish credits and regain lost trade. Compulsory working of foreign inventions under American patents would increase payrolls here and diminish to a degree the competitive onset of foreign products.

Scrap Exports at Record Figures

The foreign demand for scrap iron and steel from the United States is constantly on the increase, the present rate exceeding any previous record, as shown by the following table of Government statistics:

	Gross Tons
January, 1916	16,681
February, 1916	9,371
March, 1916	13,112
Average per month, 1915	6,613
Average per month, 1914	2,761
Average per month, 1913	8,119

The average for the first quarter of 1916 is 13,054 tons per month, which is nearly double the monthly average for 1915 of 6613 tons, and much above the previous record of 8119 tons per month in 1913. Great Britain exported 5594 tons a month in the first quarter of this year.

The Bethlehem Steel Company is arranging to establish a large steel warehouse in Cleveland, Ohio. It has just closed a deal for the purchase from the Willard Storage Battery Company of a site 300 x 330 ft., at Lakeside Avenue and Marquette Street, possession of which will be secured in four months. It is expected that the erection of the warehouse will then be started.

Iroquois Iron Company Sold to By-Products Coke Corporation

As indicated last week the option given by the Iroquois Iron Company on the greater part of its stock to C. T. Boynton, vice-president of the By-Products Coke Corporation, Chicago, has been exercised, Mr. Boynton acting for the latter company. Of the entire issue of Iroquois stock, amounting to $5,000,000, shares to the value of $4,000,000 have changed hands at the option price of $80 a share. The Iroquois Iron Company, organized in 1899, succeeded the Iroquois Furnace Company, building an additional stack at South Chicago. In 1912 two more modern furnaces had been completed upon a large tract of lake front property, giving the company at the time of its sale adjacent plant sites having a combined area of about 144 acres and four furnaces with a monthly capacity of 35,000 tons. The personnel of the Iroquois Iron Company includes M. Cochrane Armour, president; Charles A. Stillman, vice-president and treasurer; E. L. Billingslea, vice-president and sales manager, and Edwin Raum, secretary.

The By-Products Coke Corporation now has under its control six furnaces with a total capacity of 675,000 tons of pig iron a year, and 280 coke ovens with an annual capacity of 1,100,000 tons of coke. The company acquired the Federal Furnace Company in November, 1915. Pickands, Brown & Co., Chicago, are selling agents for Federal pig iron. W. L. Brown, president of the Federal Furnace Company, is chairman of the executive board of the By-Products Coke Corporation.

Railroads to Withdraw Export Freight Rates

The railroads operating in the Trunk Line Association and the Central Freight Association territories have announced that, effective Oct. 1, the special freight rates on iron and steel for export will cease to exist. On and after that date shippers will be charged the full domestic rates from Pittsburgh territory and also from the Mahoning and Shenango valleys to all Atlantic coast points. This action had been expected by iron and steel manufacturers and, in a measure, has been discounted by them. The export rates that will be in effect from Oct. 1, and which will then be the same as the domestic rates, are as follows:

From Pittsburgh to New York: On manufactured articles, 16.9c. per 100 lb., instead of 11c., an increase of 5.9c.; on billets, $2.76 per gross ton, instead of $1.84, an increase of 92c.; on pig iron, $2.58, instead of $1.74, an increase of 84c.

From the Valleys to New York: On manufactured articles, 18.9c., instead of 13c., an increase of 5.9c.; on billets, $3.16, instead of $2.24, an increase of 92c.; on pig iron, $2.98, instead of $2.14, an increase of 84c.

Corresponding changes are made in the rates to Baltimore.

The Metals Production Equipment Company, successor to the Quigley Furnace & Foundry Company, 105 West Fortieth Street, New York, has opened an office in the First National Bank Building, Chicago, with E. E. Adams in charge, for the purpose of serving its customers in the Middle West to better advantage. At present the company has four classes of product, namely, accurate temperature heat-treating and forging furnaces for oil, coal and gas fuel; powdered coal equipment; brass rolling-mill products, and gray-iron castings.

Loading pig iron into boats by electro-magnet was successfully accomplished at Ashland, Wis., last week. The steamer Cicoa, owned by the Charcoal Iron Company of America, operating the furnace at Ashland, was able to dispense almost entirely with longshoremen labor in loading its latest cargo. The boat is equipped with three lifting magnets, of a capacity of 1500 lb. each, operated by a 250-volt dynamo. The loading operations required only two men for each unit, one at the motor and the other at the magnet.

The National Association of Sheet Metal Contractors will convene at Peoria, Ill., June 20.

A HUNDRED MILLIONS FOR NAVY

That Outlay in One Year—Armor Plant and Anti-Time Study Provisions

WASHINGTON, D. C., May 30, 1916.—The rejection of the Administration's carefully worked out five-year construction program for the upbuilding of the navy, the elimination of the dreadnaught from the list of warships authorized, an increase of nearly $92,000,000 in the total appropriations as compared with last year's bill, the authorization for the construction in the discretion of the Secretary of the Navy in Government navy-yards of all the vessels appropriated for, the prohibition of the construction or purchase of vessels or war material of any kind at a cost higher than the same can be produced for in Government establishments except in emergency, and the re-enactment of the Deitrick-Tavenner provision against the use of scientific shop management in any branch of the naval service, are the leading features of the annual naval appropriation bill reported to the House during the past week. In several important respects the measure is a disappointment to Administration officials and steps already taken by them foreshadow a vigorous effort to secure the recasting of the bill in the Senate. So far as the House is concerned measures have already been taken to rush the bill through with a minimum of debate.

The construction program adopted by the Huse Committee includes five battle cruisers at $20,433,531 each, four scout cruisers at $5,571,900 each, ten destroyers at $1,325,314 each, three 800-ton submarines at $1,206,302 each, seventeen smaller submarines at $731,302 each, one fuel ship at $1,363,272, one ammunition ship at $2,704,650, one hospital ship at $2,250,000. The total cost of this program is figured at $160,087,357, of which it is estimated that $59,244,326 will be expended the first year. The bill also carries $11,245,925 for ammunition to be manufactured during the coming year, and in addition appropriates $28,369,127 for the continuation of the work on vessels heretofore authorized, making a total for construction and equipment to be disbursed during the fiscal year ending June 30, 1917, of $98,859,378.

Once more the labor leaders have been successful in forcing into the Naval bill a prohibition of scientific shop management systems in the naval service. In this instance the Deitrick-Tavenner provision, which has been adopted by the committee, thereby rendering it a comparatively easy matter to retain the section on the floor, is incorporated in the following language:

Provided, That no part of the appropriation made in this Act shall be available for the salary or pay of any officer, manager, superintendent, foreman, or other person having charge of the work of any employee of the United States Government while making or causing to be made with a stop watch or other time-measuring device a time study of any job of any such employee between the starting and completion thereof, or of the movements of any such employee while engaged upon such work; nor shall any part of the appropriations made in this Act be available to pay any premium or bonus or cash reward to any employee in addition to his regular wages, except for suggestions resulting in improvements or economy in the operation of any Government plant.

There is little hope that this amendment can be stricken out on any parliamentary grounds. Its propriety was upheld a year ago as a limitation upon the expenditure of money and being a part of existing law it cannot be attacked as new legislation subject to the point of order that it can only be adopted by unanimous consent. Nothing but a majority vote of the two houses can avail to strike it from the bill.

The majority leaders are preparng to bring forward as an amendment to the naval appropriation bill the Tillman bill authorizing the construction or purchase of a Government armor factory. A special rule will probably be reported for this purpose, which will allow of no modification in the Tillman bill, providing only for a yea and nay vote, under which there is every reason to believe the armor factory provision will be adopted.

W. L. C.

ARMY APPROPRIATIONS

The Equipment of Private Plants—Provision for Advisory Experts

WASHINGTON, D. C., May 30, 1916.—Appropriations to render effective the provisions of the Army Reorganization bill as outlined in THE IRON AGE last week have been practically decided upon by the House Committee on Military Affairs, and will aggregate about $150,000,000, or $50,000,000 larger than the army budget for the current year. A number of important "riders" of especial interest to manufacturers have been incorporated.

The so-called Tilson amendment, authorizing the Secretary of War to purchase equipment for the manufacture of small arms and ammunition to be installed in private establishments, has been added to the Military appropriation bill. The original estimate was for $5,000,000, but it is regarded improbable that the committee will allot so large a sum. This provision will permit the expenditure of any amount carried thereby without competition, thus enabling the Secretary of War to use his discretion in selecting the plants in which the special equipment will be installed.

An important feature is that providing for a council of executive information for the co-ordination of industries and resources for the national security and welfare. This council is to consist of the Secretaries of War, the Navy, the Interior, Agriculture, Commerce and Labor, and shall nominate for appointment by the President an advisory commission of not more than seven persons, "each of whom shall have special knowledge of some industry, public utility, or the development of some natural resource, or be otherwise specially qualified" in the opinion of the council for the performance of their duties. The members of the advisory commission are to serve without compensation, but will be allowed actual expenses of travel and subsistence when attending meetings of the commission or engaged in investigations pertaining to its activities. The functions of the council, in the discharge of which the advisory commission will co-operate, are set forth in the bill as follows:

> That it shall be the duty of the Council of Executive Information to supervise and direct investigations and make recommendations to the President and the heads of executive departments as to the location of railroads with reference to the frontier of the United States so as to render possible expeditious concentration of troops and supplies to points of defense; the co-ordination of military, industrial, and commercial purposes in the location of extensive highways and branch lines of railroad; the mobilization of military and naval resources for defense; the increase of domestic production of articles and materials essential to the support of armies and of the people during the interruption of foreign commerce; the development of sea-going transportation; data as to amounts, location, method and means of production, and availability of military supplies; the giving of information to producers and manufacturers as to the class of supplies needed by the military and other services of the Government, the requirements relating thereto, and the creation of relations which will render possible in time of need the immediate concentration and utilization of the industrial resources of the nation.

At this writing a sharp contest is being waged in the Military Committee over the question as to whether the so-called Deitrick-Tavenner amendment, prohibiting scientific shop management systems in Government establishments, shall be added to the military appropriation bill.

W. L. C.

The Wilmington Iron Works, Wilmington, N. C., through its New York office, has contracted with a large New York corporation, through Cox & Stevens, naval architects, for the construction of four 220-ft. wooden cargo schooners. These vessels will be rushed to completion and will be used in the Southern trade where the demand is so great and the ocean freight so remunerative. The company's New York office is located at 1 Madison Avenue. Herbert Crapster, treasurer of the Valve Sales Company, will also be the New York manager of the Wilmington Iron Works.

Master Boiler Makers' Convention

The tenth annual convention of the Master Boiler Makers' Association was held at the Hollenden Hotel, Cleveland, Ohio, May 23 to 26, with an attendance of about 600. During the four days' session many committee reports were presented and discussions engaged in on various topics of special interest to railroad boiler makers. A paper on the effect of sulphur in steel was presented by Dr. J. S. Unger, central research bureau of the Carnegie Steel Company, Pittsburgh. The National Tube Company enlivened one of the sessions with its series of motion pictures on the making of pipe from ore to the finished product. One afternoon was devoted to a tour of inspection through the Collinwood shops of the New York Central Railroad. In connection with the convention there was an exhibit of boiler tools and appliances, about forty manufacturers being represented.

Officers for the ensuing year were elected as follows: D. A. Lucas, Havelock, Neb., president; John B. Tate, Altoona, Pa., first vice-president; Charles P. Patrick, Cleveland, second vice-president; Thomas Lewis, Sayre, Pa., third vice-president; T. P. Madden, St. Louis, Mo., fourth vice-president; E. W. Young, Dubuque, Iowa, fifth vice-president; Harry D. Vought, New York, secretary; Frank Gray, Bloomington, Ill., treasurer. L. M. Stewart, Waycross, Ga.; John Harthill, Cleveland, and John Rapps, Chicago, were elected to the executive board, of which Thomas F. Powers, Oak Park, Ill., was chosen chairman and W. H. Laughridge, Columbus, Ohio, was made secretary.

P. A. Clemens, Chicago, was elected president of the Boiler Makers' Supply Association; George Slate, New York, secretary and treasurer, and H. S. Covey, Cleveland, and George R. Boyce, Chicago, were placed on the executive board. Mrs. Frank Gray, Bloomington, Ill., was made president of the Women's Auxiliary of the Boiler Makers' Association.

St. Louis Screw Company Installs Puddle Mill

The provision made by the St. Louis Screw Company for the future installation of a 20-in. puddle mill in its new works was described in THE IRON AGE of July 8, 1915. That mill is now being erected and will be ready for operation, it is expected, by Sept. 1. It is a two-stand, three-high mill, built by the Lewis Foundry & Machine Company, and will be driven from a 600-hp. Allis-Chalmers motor by a Morse high-speed silent chain drive such as is also installed in connection with the main drive for the 18-in. mill, the motor running at 300 r.p.m. and the mill at 60 r.p.m. The chain consists of two strands 18 in. wide, 2-in. pitch and drives on 102-in. centers. The squeezer is driven by means of gearing from the train drive. For the puddling furnaces powdered coal will be used as in the other furnaces of the mill. In connection with the installation of this mill, it is of particular interest to note that the unique features of this plant—the use of powdered coal and the chain drive—are, after a year of operation, found to be so satisactory as to warrant a more extended adoption.

The Texas Steel Company, Beaumont, Tex., has been incorporated with a capital stock of $2,500,000, adding another to the considerable list of Texas projects in iron and steel. The directors are L. P. Featherstone, C. T. Heisig, John L. Keith, T. S. Reed, M. Guiterman and S. G. Burnet, of Beaumont; L. L. Featherstone, T. C. Morgan and J. Turner, Jr., of Longview. The company's reported plans include the building of a blast furnace, the erection of a cast-iron pipe plant, and the construction of a railroad to iron ore lands in Texas controlled at present by L. P. Featherstone. Announcement was made in January of similar plans of the same interests.

Recent reports connecting the Simmons Hardware Company, St. Louis, and other interests with negotiations for the purchase of the Hillman Land & Iron Company's furnace at Hematite, Ky., are without foundation. The furnace was last operated in 1912. Its product is cold blast charcoal pig iron.

BRITISH STEEL EXPORTS

April Record Still High—Imports Show a Considerable Decline

April exports of British iron and steel, excluding iron ore and including scrap, were 293,897 gross tons. Despite the government order of mid-April to prohibit exports, this is the largest month this year except March when the exports were 307,488 tons and compares with 270,858 tons per month for 1915.

Pig-iron exports in April were 71,488 tons, and for the first four months to May 1, 1916, the total was 290,714 tons, of which France took 159,468 tons and Italy 63,734 tons. Steel-bar exports were 84,272 tons, of which France took 48,359 tons. For the first four months this year the total has been 221,973 tons, France taking 186,128 tons. April ferromanganese exports were about 11,000 tons against 13,000 tons in February. For the first four months the total was about 42,000 tons, against 14,000 tons to May 1, 1915.

Rail shipments in April, 10,510 tons, exceed the total for the previous three months of this year. The movement in galvanized sheets was 13,462 tons, against 31,408 in April, 1915. Tin-plate exports were 23,337 tons, making the total to May 1, 116,379 tons, against 130,622 tons to May 1, 1915.

April's iron and steel imports were 66,072 tons and were the lowest for any month this year, the average for the first three months having been 79,211 tons per month. The import rate is thus well below the 1915 monthly average of 107,944 tons. Imports of blooms, billets and slabs continue to decline, having been only 7832 tons in April, of which 6046 tons went from the United States. To May 1 this year the total was 46,649 tons, against 87,661 tons to May 1, 1915, of which 62,609 tons was from the United States.

Innovation in Welsh Tin-Plate Practice

THE IRON AGE'S London correspondent writes: "A new tin-plate plant has gone into operation in one of the Welsh works and has attracted considerable attention in the British trade. The finished black plates as they come from the cold rolls and annealing furnaces are passed, without any handling, through the pickling, washing, tinning and cleaning processes, and the finished plates are piled up as completed, ready for boxing and shipment. One pot which has been running a few weeks under ordinary working conditions is turning out about 2200 base boxes a week, and another pot, just started up, made even a better output. The innovation is said to be the most important introduced since the invention of the Morewood pot. Great economies are effected by the new plan of working, three handlings being saved that are usual in the most up-to-date conditions. This is the most important consideration at the present juncture, owing to the wholesale exhaustion of the labor forces of the country owing to the war."

American Car & Foundry to Roll Alloy Steel

The American Car & Foundry Company is to put its rolling mills at Detroit into operation to roll alloy steel for automobile manufacturers, with enough under order, it is admitted, to keep the plant busy for two years. Some remodeling of the mill will be necessary. It includes two stands of 20-in. rolls, three high; three stands of 16-in. rolls, three high, and six stands of 12-in. rolls, three high. As a merchant bar-iron mill, the annual capacity is put at 60,000 tons. The rolling plant is a part of the Detroit Forge department of the company, formerly the Michigan-Peninsular works.

The Valley Steel Company, a new concern located in East St. Louis, Ill., has completed its financing and is now in operation manufacturing steel axles for steam and electric cars, as well as turning out all types of heavy steel forgings. Its issue was $150,000 common and $100,000 preferred stock. W. H. Wallace is president.

CONTENTS

Originality in a Hartford Machine Works 1305
Time-Saving Time System 1309
Germany and Norway's Iron Mines 1309
Steel Castings and Physical Properties 1310
Dual Purpose 100-Ton Hydraulic Forcing Press 1313
Iron, Steel and Hardware Convention 1314
Milling Machine for Manufacturing Work 1316
Bearing with Graphite Sheet Lubricator 1316
Italy's Need of Metallurgical Fuel 1316
Utilizing Powdered Coal at Lebanon, Pa 1317
Brittle Annealed Copper 1319
World Questions and Co-operation at Home Uppermost at the Steel Meeting 1320-1321
Power in Rolling Steel 1338
New Bessemer Plant Near Chicago 1339
A Bureau of Research in Sales Methods 1339
A Machinable Acid-Proof Iron 1339
Canadian Car & Foundry Report 1339
Our Foreign Trade 1340
Concerning Co-operation 1341
A New Epoch in Electric Steel 1341
The War and American Patents 1342
Scrap Exports at Record Figures 1342
Iroquois Iron Company Sold 1343
Railroads to Withdraw Export Freight Rates 1343
A Hundred Millions for Navy 1343
Army Appropriations 1344
Master Boiler Makers' Convention 1344
St. Louis Screw Company Installs Puddle Mill 1344
British Steel Exports 1345
Innovation in Welsh Tin Plate Practice 1345
American Car & Foundry to Roll Alloy Steel 1345
Iron and Steel Markets 1346
The Benzol and Toluol Market 1357
Australian Iron and Steel Imports 1357
Iron and Industrial Stocks 1357
Change in Height of Head on Set Screws 1357
British Imports of Manganese Ore 1357
Finished Iron and Steel Prices, Pittsburgh 1358
Metal Markets 1359
New Construction at Lorain, Ohio 1359
Obituary 1360
Personal 1360
For Russian Trade with United States 1360
Pittsburgh and Nearby Districts 1361
The H. Koppers Company in the Northwest 1361
Sizer Forge Company Building a New Plant 1361
Strikes and Wage Advances 1362
Locomotive Buying Still Active 1362
Australian Firm Opens American Office 1362
Machinery Markets and News of the Works 1363
Fluorspar Production Breaks Record 1373
New Trade Publications 1374

Iron and Steel Markets

FOREIGN DEMAND GREATER

Requirements Apart from War Buying

Pig-Iron Trade Slackens and Prices Are Lower—High Lake Freights

Steel manufacturers in the past week at the largest gathering the industry has known agreed that high prices and full operation will continue through the year and many count on a straight year of to-day's prosperity. One year ago at a like meeting a 75 per cent operation was found to be the rule.

It appears that as the pressure of new domestic business at premium prices relaxes, foreign inquiry increases. The fact is that buyers abroad, apart from those placing war orders, want to restock, but not at famine prices; and now that freights have come down from such impossible figures as $42 on pig iron to Italy, they are trying to do business.

Pig-iron inquiry for Italy and France, long inactive, is being revived and there is a large foreign business pending in tin plate and barb wire. Russia's requirements of the latter are put well above 100,000 tons, but in this as in other export negotiations there are evident duplications. There is an Italian offer on 10,000 tons of rail blooms and France's large rail orders have just been increased by 35,000 tons, taken by an Eastern mill.

The growth of this foreign demand is seen in the initial orders of one buyer of ship steel for the Orient, now in this country, who will place about 30,000 tons a year.

The ability of the mills to take care of considerable high-priced steel, on which delivery is wanted in the second half of this year, is being demonstrated week by week, in spite of the generally sold-up condition. Moreover, sales of semi-finished steel at concessions from recent prices continue, but they are apart from the general current. For example, some high-carbon billets sold at $40 at Chicago. They were intended for munitions work, but were rejected. On soft steel billets, Pittsburgh prices of $42 and less are still reported.

Mills and buyers are coming to a basis on fourth quarter deliveries of products on which some mills have held back—particularly bars, plates and shapes. At Chicago, orders are being placed for delivery in the second half at 2.50c., Pittsburgh, for structural steel, 2.75c. for universal plates and 2.90c. for sheared plates, and Bessemer bars are to be had at 2.75c., Pittsburgh, with rail steel bars for the second half at 2.50c.

Track fastenings have figured on a large scale in Western railroad contracts, a single line having taken 35,000 tons of angle bars, tie plates, bolts and spikes. On the last two this contract showed an advance of $3 a ton. But railroad buying generally is of very moderate proportions. For steel car companies the prospect is by no means bright.

Builders of gas and oil lines have sounded the pipe market in view of various projected extensions, but have gone no farther, as present prices are double those of last year.

May outputs of sheet and tin-plate mills established new records; it is expected also that the May production of steel ingots will reach a new high figure. But with the labor situation what it is, producers look forward to lessened operations as hot weather comes on.

Pig-iron buying has slackened materially and the amount of solicitation for business has been sufficient to create an easier market. Further sales of Southern iron have been made at $14.75 for this year and Northern grades are yielding, though not to the same extent. Producers count on the ending of foundry strikes to strengthen the market and to bring the spot demand they have long awaited.

An Eastern steel company has bought 20,000 tons of Southern basic iron at a figure slightly below the basis for Northern basic, and some negotiations for basic iron are still on in the East.

A sharp reminder of the possibilities of the situation in iron-ore freights came in the past week in the closing of Lake Erie charters at $1, exclusive of unloading charges, or at double the season contract rate. The payment of 60 cents from Escanaba to South Chicago also represents a 100 per cent advance.

Pittsburgh

PITTSBURGH, PA., May 30, 1916.

The past week has been marked by a material increase in the export inquiries for nearly all kinds of iron and steel products, but notably pig iron, tin plate and wire. The lower ocean freights are given as the main reason for this increase. Export inquiries are in this market for 25,000 to 30,000 tons of Bessemer pig iron, also for large lots of tin plate, barb and plain wire, rivets and wire rods. The domestic demand for finished iron and steel is quiet, consumers not being willing to place contracts with the mills at premium prices, and on which they cannot possibly get deliveries before last quarter of this year, or first quarter of 1917. The mills are satisfied with this condition, as they have all the orders on their books they can turn out in the next five or six months, and in some products in the entire year. With the coming of hot weather, there will likely be a material falling off in the output of pig iron and finished products, and this will take up a large part of the slack that may come through any falling off in domestic orders. There is some weakness in prices of galvanized sheets, and the scrap market is dull and neglected, prices being lower than for several months. Best grades of prompt furnace coke are up about 25c. per ton, due largely to

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

Pig Iron, Per Gross Ton:	May 31, 1916.	May 24, 1916.	April 26, 1916.	May 26, 1915.
No. 2 X, Philadelphia...	$20.50	$20.50	$20.50	$14.25
No. 2, Valley furnace....	18.00	18.00	18.50	12.75
No. 2 Southern, Cin'ti...	17.90	17.90	17.90	12.40
No. 2, Birmingham, Ala.	15.00	15.00	15.00	9.50
No. 2, furnace, Chicago*	19.00	19.00	19.00	13.00
Basic, del'd, eastern Pa..	20.50	20.50	20.50	13.25
Basic, Valley furnace....	18.00	18.00	18.00	12.50
Bessemer, Pittsburgh....	21.95	21.95	21.95	14.70
Malleable Bess., Ch'go*..	19.50	19.50	19.50	13.00
Gray forge, Pittsburgh.	18.70	18.70	18.70	13.45
L. S. charcoal, Chicago..	19.75	19.75	19.75	15.75
Billets, etc., Per Gross Ton:				
Bess. billets, Pittsburgh..	45.00	45.00	45.00	20.00
O.-h. billets, Pittsburgh..	42.00	42.00	45.00	20.00
O.-h. sheet bars, P'gh....	42.00	42.00	45.00	21.00
Forging billets, base, P'gh	69.00	69.00	68.50	26.00
O.-h. billets, Phila.....	50.00	50.00	50.00	22.02
Wire rods, Pittsburgh..	60.00	60.00	60.00	25.00
Finished Iron and Steel, Per Lb. to Large Buyers	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.47½	1.47½	1.25	1.25
O.-h. rails, heavy, at mill	1.56½	1.56½	1.34	1.34
Iron bars, Philadelphia..	2.659	2.659	2.659	1.17½
Iron bars, Pittsburgh...	2.60	2.60	2.50	1.20
Iron bars, Chicago.....	2.35	2.35	2.35	1.15
Steel bars, Pittsburgh...	3.00	3.00	3.00	1.20
Steel bars, New York...	3.169	3.169	3.169	1.369
Tank plates, Pittsburgh..	3.75	3.75	3.75	1.15
Tank plates, New York.	3.919	3.919	3.919	1.319
Beams, etc., Pittsburgh.	2.60	2.60	2.60	1.20
Beams, etc., New York...	2.769	2.769	2.769	1.369
Skelp, grooved steel, P'gh	2.35	2.35	2.35	1.15
Skelp, sheared steel, P'gh	2.45	2.45	2.45	1.20
Steel hoops, Pittsburgh..	2.75	2.75	3.00	1.25

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire, Per Lb. to Large Buyers	May 31, 1916. Cents.	May 24, 1916. Cents.	April 26, 1916. Cents.	May 26, 1915. Cents.
Sheets, black, No. 28, P'gh	2.90	2.90	2.85	1.75
Galv. sheets, No. 28, Pgh	4.75	4.75	5.00	3.75
Wire nails, Pittsburgh...	2.50	2.50	2.40	1.55
Cut nails, Pittsburgh....	2.60	2.60	2.60	1.55
Fence wire, base, P'gh..	2.45	2.45	2.25	1.35
Barb wire, galv., P'gh..	3.35	3.35	3.25	2.10
Old Material, Per Gross Ton:				
Iron rails, Chicago.....	*17.50*	18.00	18.00	12.25
Iron rails, Philadelphia..	20.00	20.00	20.00	15.00
Carwheels, Chicago.....	*12.75*	13.00	13.50	9.75
Carwheels, Philadelphia.	16.50	16.50	17.00	11.50
Heavy steel scrap, P'gh..	*16.50*	16.75	17.25	11.75
Heavy steel scrap, Phila	16.00	16.00	17.50	11.00
Heavy steel scrap, Ch'go	*15.50*	15.75	16.50	9.50
No. 1 cast, Pittsburgh..	16.00	16.00	16.25	12.00
No. 1 cast, Philadelphia.	17.50	17.50	17.50	12.25
No. 1 cast, Ch'go (net ton)	*12.00*	12.50	12.75	9.00
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt...	**$2.50**	$2.25	$2.00	$1.50
Furnace coke, future....	2.50	2.50	2.40	1.65
Foundry coke, prompt...	**3.25**	3.00	3.25	2.00
Foundry coke, future....	3.25	3.25	3.25	2.15
Metals, Per Lb. to Large Buyers	Cents.	Cents.	Cents.	Cents.
Lake copper, New York..	*28.25*	29.00	28.75	21.00
Electrolytic copper, N. Y.	*28.00*	28.50	28.50	18.50
Spelter, St. Louis.....	*13.75*	14.75	18.00	18.75
Spelter, New York.....	*14.00*	15.00	18.25	19.00
Lead, St. Louis.....	7.20	7.25	7.37½	4.22½
Lead, New York.....	7.35	7.45	7.50	4.30
Tin, New York.....	*46.75*	48.00	49.75	37.87½
Antimony, Asiatic, N. Y.	*25.00*	28.00	39.50	35.00
Tin plate, 100-lb. box, P'gh	$5.50	$5.50	$4.50	$3.15

the fact that furnaces are rejecting some shipments of coke, and are willing to pay a little higher price for the best grades.

Pig Iron.—There is more export than domestic inquiry for Bessemer. Foreign inquiries include one lot of 10,000 tons of Bessemer, another of 8000 tons, and a third of 5000 tons. Ocean freights from New York to Italy have been about $42 per ton, but these have been reduced to about $30, with a prospect that $25 will be the rate in a short time. This is given as the reason for the increased inquiry for Bessemer iron, and it is probable that several of the lots now under negotiation may be closed this week. We note a sale of 1000 tons of Bessemer for export at $21 at furnace. Most furnaces are holding No. 2 foundry at $18.25 to $18.50, but there are one or two sellers naming $18 at furnace. We note sales of 1200 to 1500 tons of No. 2 foundry at about $18.25 at furnace, but resale foundry iron is being offered at about $18 at furnace. We quote Bessemer iron at $21; basic, $18; gray forge, $17.75 to $18; No. 2 foundry, $18 to $18.50, and malleable Bessemer, $18.50 to $19, all at Valley furnace, the freight rate to the Pittsburgh or Cleveland district being 95c. per gross ton.

Billets and Sheet Bars.—It is stated that prices on open-hearth billets and sheet bars are firmer, and local mills will not sell at less than about $45 at mill. However, open-hearth billets and sheet bars are being brought in from outside mills at $42 to $43, Pittsburgh. A local consumer is reported to have bought 1000 tons of open-hearth bars last week, coming from an outside mill, at about $42, delivered. Deliveries of steel to the sheet and tin-plate mills are much better. We quote soft open-hearth billets and sheet bars at $42 to $43; Bessemer billets, $45; Bessemer sheet bars, $45, maker's mill, Pittsburgh or Youngstown district. We quote forging billets at $69 for sizes up to but not including 10 x 10 in., and for carbons up to 0.25, the regular extras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take $1 extra.

Ferroalloys.—There is very little new inquiry for prompt ferromanganese, consumers being covered for some time ahead, and much of the former uneasiness as regards future supply is absent. We note sales of two carloads of 80 per cent domestic ferromanganese for spot shipment at about $325, delivered, and we quote 80 per cent at $325 to $350, delivered. We quote 50 per cent ferrosilicon at $85 for lots up to 100 tons, over 100 tons and up to 600 tons, $84, and over 600 tons, $83, all per gross ton, f.o.b. Pittsburgh. Prices of Bessemer ferrosilicon for delivery over remainder of the year are now quoted as follows: 9 per cent, $32; 10 per cent, $33; 11 per cent, $34; 12 per cent, $35; 13 per cent, $36.50; 14 per cent, $38.50; 15 per cent, $40.50, and 16 per cent, $43. Seven per cent silvery for the same delivery is $28.50; 8 per cent, $29; 9 per cent, $29.50; 10 per cent, $30; 11 per cent, $31, and 12 per cent, $32. All these prices are f.o.b. at furnace, Jackson or New Straitsville, Ohio, or Ashland, Ky., each of these points having a freight rate of $2 per gross ton to Pittsburgh.

Steel Rails.—There is nothing doing in standard sections, only an occasional small lot being placed, but the demand for light rails is quite active, new orders and specifications running 5000 tons or more per week. We quote light rails as follows: 25 to 45 lb. sections, 2.10c.; 16 and 20 lb., 2.15c.; 12 and 14 lb., 2.20c., and 8 and 10 lb., 2.25c., in carloads and up to 100 tons. An advance of 5c. per 100 lb. is charged for less than carloads and down to 3 tons, while under 3 tons an additional 5c. is charged. We quote standard section rails of Bessemer stock at 1.47½c., and open-hearth steel, 1.56½c., Pittsburgh.

Plates.—A leading plate mill outside this city is reported to have sold recently 4000 tons of ¼-in. plates for delivery in six to eight weeks at about 4c. at mill. There are no active inquiries out for steel cars. Leading plate mills are filled up for the remainder of the year, and the Carnegie Steel Company has taken large contracts for plates for delivery in first and second quarters of 1917. We quote ¼-in. and heavier plates for delivery at convenience of the mill, which would mean probably last quarter, at 2.75c. to 2.90c., while for shipment in two to three months 3.50c. to 4c. and higher are quoted.

Structural Material.—New inquiry is reported active in spite of the high prices ruling on plain material, but, as stated before, local fabricators are not bidding

actively on new work coming up, being practically filled for the remainder of this year. The Blaw Steel Construction Company has taken 700 tons for extensions to the plant of the Ludlum Steel Company, Syracuse, N. Y., and the Fort Pitt Bridge Works, 850 tons for grade crossing work for the New York Central Railroad at Niagara Falls, N. Y. We quote beams and channels up to 15 in. at 2.60c. to 2.75c. at mill, for delivery in third and fourth quarters of this year. Small lots for prompt delivery from warehouse stocks are held at about 3.25c. to 3.50c. and higher.

Sheets.—Several of the larger mills report that on blue annealed, electrical and special grade sheets for deep stamping purposes they have their output sold up for the remainder of this year, while on light black and galvanized the best deliveries they can make are 10 to 12 weeks. The new demand is not active, and some mills are showing more desire to book orders, particularly for galvanized, and there is some shading in prices on the latter. However, some mills say they will not cut prices to any extent on galvanized, but will put the steel into other sheets in which there is more profit. Specifications against contracts are active and shipments are heavy. Several mills expect to break all records for output of sheet mill products in May for any one month. It is said several large contracts for blue annealed sheets have been closed lately for extended delivery at above 3c. at mill. We quote blue annealed sheets, Nos. 9 and 10 gage, at 3c. to 3.25c., some mills quoting as high as 3.50c. We quote No. 28 Bessemer black sheets at 2.90c. to 3c., and open-hearth, 3c. to 3.10c.; No. 28 galvanized Bessemer stock, 4.75c. to 4.85c., and open-hearth, 4.90c. to 5c. We quote Nos. 22 and 24 black plate, tin mill sizes, H. R. and A., 2.70c.; Nos. 25, 26 and 27, 2.75c.; No. 28, 2.85c.; No. 29, 2.95c., and No. 30, 3c. These prices are for carload and larger lots, f.o.b. mill, Pittsburgh.

Tin Plate.—Domestic sales of tin plate have been made for shipment from stock at $5.75 per base box, and for export at $6 to $6.10. Several leading makers say they have no tin plate to spare for the remainder of this year, and are not quoting on either domestic or foreign inquiries. Output and shipments are heavy, the mills operating as close to 100 per cent of capacity as the supply of steel will permit. We quote from stock at $5.75 to $6, and for export $6 to $6.10 per base box. We quote 8-lb. coated ternes at $7.75 for 200 lb. and $8.25 for 214 lb., all f.o.b. maker's mill, Pittsburgh.

Cold-Rolled Strip Steel.—Consumers are still placing orders quite freely, and we note one contract for 3500 tons at $6 base per 100 lb. for delivery over the remainder of the year, also two contracts for 600 tons each at the same price and for the same delivery, and 865 tons at $6 for third and fourth quarter delivery, and a few small lots for delivery in four to five months at $6.50. With actual specifications in hand against orders on their books, none of the makers can promise delivery inside of about 22 weeks, while several state their output is practically sold for the remainder of this year. Extras, standard with all the mills, were printed in full on page 810 in THE IRON AGE of March 30.

Skelp.—Few sales are being made, as local mills have their output sold up for practically the remainder of this year. Prices are nominal. We quote grooved steel skelp at 2.35c. to 2.40c.; sheared steel skelp, 2.45c. to 2.50c.; grooved iron skelp, 2.70c. to 2.80c., and sheared iron skelp, 3c. to 3.10c., all delivered to consumers' mills in the Pittsburgh district.

Railroad Spikes.—A Southern road has placed an order with two local makers for 12,000 to 15,000 kegs for 1917 delivery. While new inquiry for next year is fairly active, the railroads are slow in closing. Some makers of spikes say if they run short of orders for spikes they will divert the steel to other products rather than lower the price. One maker is reported to be quoting slightly less than regular prices. We quote:

Standard railroad spikes, 4½ x 9/16 in. and larger, $2.65 to $2.75; railroad spikes, ½ and 7/16 in., $2.75 base; railroad spikes, ⅜ in. and 5/16 in., $3.05 base; boat spikes, $2.80 base, all per 100 lb., f.o.b. Pittsburgh.

Nuts and Bolts.—Makers report the supply of steel a little better, and this is permitting a larger output. Domestic demand is quiet, as most consumers are covered over remainder of the year, but there is still a good export inquiry. Discounts in effect from May 19, which the makers state are for prompt acceptance only, are as follows, delivered in lots of 300 lb. or more where the actual freight rate does not exceed 20c. per 100 lb., terms 30 days net, or 1 per cent for cash in 10 days:

Carriage bolts, small, rolled thread, 50 and 10 per cent; small, cut thread, 50; large, 40.

Machine bolts, h.p. nuts, small, rolled thread, 50, 10 and 5 per cent; small, cut thread, 50 and 5; large, 40 and 10.

Machine bolts, c.p.c. and t. nuts, small, 40, 10 and 5 per cent; large, 35 and 5.

Blank bolts, 40 and 10 per cent; bolt ends, with h.p. nuts, 40 and 10; with c.p. nuts, 35 and 5. Rough stud bolts, 15. Lag screws (cone or gimlet point), 50 and 10.

Forged set screws and tap bolts, 10 per cent. Cut and round point set screws, case hardened, 60. Square and hexagon head cap screws, 55. Flat, button, round or fillister head cap screws, 30.

Nuts, h.p. sq., tapped or blank, $2.90 off list; hex., $2.90 off; c.p.c. and t. sq. tapped or blank, $2.60 off; hex., $3 off; semi-finished hex., 60 and 10 per cent; finished and case hardened, 60 and 10.

Rivets, 7/16 in. in diameter and smaller, 45, 10 and 10 per cent.

Rivets.—Local makers state they are holding firmly for the higher prices on rivets, effective from May 19. Domestic demand is only fair, as most consumers are covered ahead, but there is still heavy export inquiry, one local maker closing lately for two carloads for shipment to India and another to South America. We quote buttonhead structural rivets, ½ in. in diameter and larger, at $4 per 100 lb., base, and conehead boiler rivets, same sizes, $4.10 per 100 lb., base, f.o.b. Pittsburgh. Terms are 30 days net, or one-half of 1 per cent for cash in 10 days.

Shafting.—The new demand is only fairly active for the reason that most consumers are covered over remainder of the year, and local makers have their output sold up for practically the same period. Recently some large contracts for delivery in last quarter were made at 15 per cent off list. Specifications against contracts are reported heavy. We quote cold-rolled shafting at 15 per cent off in carload lots for delivery in third and fourth quarters, and 10 per cent off in less than carload lots, f.o.b. Pittsburgh, freight added to point of delivery.

Wire Rods.—A local maker closed a sale recently of 300 to 400 tons of rods on the basis of $62 for soft rods, and up to $67 for high carbon. Local makers are not quoting on domestic or foreign inquiries to any extent, as their output is sold up over the next five or six months. We quote soft Bessemer, open-hearth and chain rods at $60 to $62 per ton, f.o.b. Pittsburgh.

Wire Products.—The new demand for wire nails and wire has quieted down, consumers being covered ahead for some time, and the mills have all the orders they can turn out in the next three or four months or longer. The demand for fence wire from the farming districts is only fair, due to the high prices ruling, but with any falling off in orders for fence wire that might become serious, the mills will put the steel into other products for which there is an active demand. The ruling price for wire nails is $2.50, but several local mills have taken contracts at $2.60, and one mill has orders on its books at $2.70 base for last quarter delivery. Regular prices in effect from May 1 are as follows: Wire nails, $2.50 to $2.60 per keg; galvanized, 1 in. and longer, taking an advance over this price of $2, and shorter than 1 in., $2.50. Plain annealed wire, $2.45 per 100 lb.; galvanized wire, $3.15; galvanized barb wire and fence staples, $3.35; painted barb wire, $2.65; polished fence staples, $2.65; cement coated nails, $2.50, base, all f.o.b. Pittsburgh, with freight added to point of delivery, terms 60 days net, less 2 per cent off for cash in 10 days. Discounts on woven wire fencing are now 61½ per cent off list for carload lots, 60½ per cent for 1000-rod lots and 59½ per cent for small lots, f.o.b. Pittsburgh.

Iron and Steel Bars.—A heavy inquiry is in the market from implement makers for their supply of steel bars for first half of 1917. While reported contracts have

been placed for this delivery at 2.35c., one or two local makers say they are not disposed to sell for first half of next year under 2.50c. at mill. Two leading mills have their output of steel bars sold over the remainder of this year on old contracts, and are not actively quoting on new inquiries. The new demand for iron bars is less active, most consumers being covered for three or four months ahead, and are not disposed to pay the premium prices quoted for third and fourth quarter delivery. There is some doubt as to whether a prompt settlement of the Amalgamated wage scales for bar-iron mills, effective from July 1, will be made, as quite heavy advances are asked for in the new scale. Specifications on steel bars from the car builders are fairly active for delivery up to August, but there is nothing beyond that month. We quote steel bars at 2.75c. to 2.90c. for delivery at convenience of the mill, which would not be before last quarter. Small lots of fairly prompt shipment bring as high as 3.25c. at mill. We quote refined iron bars at 2.60c. to 2.75c.; railroad test bars, 2.70c. to 2.80c. at mill. These prices are for delivery at convenience of the mill, and for fairly prompt shipment premiums would be paid.

Hoops and Bands.—The price of the Carnegie Steel Company on hoops and bands for shipment at its convenience is 2.50c. at mill, but this would probably mean for first quarter in 1917. Other makers that can ship out in third and fourth quarters are quoting 2.75c. on contracts, while for earlier delivery, 3c. is quoted on both hoops and bands, the latter carrying the steel-bar card extras. We therefore quote hoops and bands at a range of 2.50c. to 3c., prices depending entirely on deliveries wanted.

Merchant Steel.—Output and shipments are still enormously heavy and mills are not catching up on back deliveries to any extent. Most mills have their output sold for remainder of this year and specifications are very heavy. On small lots, for indefinite delivery, prices are about as follows: Iron-finished tire, ½ x 1½ in. and larger, 2.35c., base; under ½ x 1½ in., 2.50c.; planished tire, 2.55c.; channel tire, ¾ to ⅞ and 1 in., 2.85c. to 2.95c.; 1⅛ in. and larger, 3.25c.; toe calk, 2.95c. to 3.05c., base; flat sleigh shoe, 2.70c.; concave and convex, 2.75c.; cutter shoe, tapered or bent, 3.25c. to 3.35c.; spring steel, 2.95c. to 3.05c.; machinery steel, smooth finish, 2.75c.

Cotton Ties.—The price on cotton ties for the 1916 season is expected to be made soon after June 1. Mills have been rolling cotton ties for some time and are well prepared to take care of the demand when the season opens.

Wrought Pipe.—There are some inquiries in the market for gas and oil lines, mostly from Texas and Oklahoma, but nothing is being done, as the mills cannot make deliveries, and the gas and oil interests object strongly to paying the present high prices on line pipe, which are more than double what they were this time last year. On some lap-weld sizes, notably 4, 6, 8 in. and larger, some mills report they are sold up for 32 to 36 weeks. Output and shipments of pipe at this time are the heaviest ever known in the trade. Prices are very firm, and there is some talk of another advance, effective June 1, or shortly after, but nothing official has been given out. Discounts on black and galvanized iron and steel pipe are given on another page.

Boiler Tubes.—On locomotive and merchant tubes, both iron and steel, the mills are practically sold out for remainder of this year. Two leading makers have not been quoting on new orders for several months. Prices are very strong and another advance is looked for about June 1. Discounts on iron and steel tubes are given on another page.

Coke.—Coke has become so plentiful that some furnaces are rejecting some shipments of the lower grades, and this has resulted in prices of the best grades of furnace coke advancing about 25c. per ton. There is not much demand for prompt coke, and nothing is doing on contracts for last half of the year. We now quote best grades of furnace coke for prompt shipment at $2.50 to $2.60 per net ton at oven, and on contracts for last half of the year producers are quoting $2.75, which the furnaces refuse to pay. We quote best grades of foundry coke for spot shipment at $3 to $3.25, and on contracts for last half of the year, $3.25 to $3.50 per net ton at oven. The Connellsville *Courier* reports the output of coke in the Connellsville region for the week ended May 20 as 434,441 net tons, an increase over the previous week of 6237 tons.

Old Material.—The local market is still very dull, consumers not being interested, even at the low prices at which all grades of scrap are being offered, as compared with three or four weeks ago. Borings, turnings and heavy steel scrap are particularly quiet and are again lower. There is a fair demand for low phosphorus melting scrap, and we note a sale of about 1000 tons, with phosphorus guaranteed under 0.035, at about $21, delivered. We note a sale of 500 tons of carwheels at a little above $14.50, delivered; also 1000 tons of re-rolling rails at $16.75, delivered, and 500 tons of No. 1 railroad wrought scrap at $20.75, Johnstown, the latter having been sold for Eastern delivery. Prices on nearly all grades are from 25c. to 50c. per ton lower. Dealers quote for delivery in the Pittsburgh and near-by districts that take the same rates of freight, per gross ton, as follows:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh, delivered	$16.50 to $16.75
No. 1 foundry cast	16.00 to 16.50
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	16.50 to 16.75
Hydraulic compressed sheet scrap	15.00 to 15.50
Bundled sheet scrap, sides and ends, f.o.b. consumers' mills, Pittsburgh district	13.00 to 13.25
Bundled sheet stamping scrap	12.00 to 12.25
No. 1 railroad malleable stock	14.25 to 14.50
Railroad grate bars	12.00 to 12.25
Low phosphorus melting stock	20.50 to 21.00
Iron car axles	25.50 to 26.00
Steel car axles	18.00 to 18.50
Locomotive axles, steel	28.00 to 28.50
No. 1 busheling scrap	13.50 to 14.00
Machine-shop turnings	9.50 to 9.75
Old carwheels	15.00 to 15.25
Cast-iron borings	9.25 to 9.50
*Sheet bar crop ends	18.50 to 18.75
No. 1 railroad wrought scrap	19.25 to 19.50
Heavy steel axle turnings	12.00 to 12.25
Heavy breakable cast scrap	14.00 to 14.50

*Shipping point.

Chicago

CHICAGO, ILL., May 29, 1916.

Offerings of high-carbon billets at $40, Chicago, being steel intended for ammunition but rejected for that purpose, are typical of no small part of the recent billet and bar steel made available for purchase, and throw some light upon the appearances of weakness in semi-finished products. The limitations on the offerings of Bessemer structural steel in the smaller sizes, as well as some open-hearth material, at 2.50c., Pittsburgh, for shipment at mill convenience in the last half, also diminish the significance of facts pointing to easier mill conditons. Specifications for structural steel at 2.50c., universal plates at 2.75c., and sheared plates at 2.90c., all at Pittsburgh, can still be placed, but not in unlimited quantities. Mild steel Bessemer bars can be had in small amounts for early delivery at 2.75c., Pittsburgh In general the mills are continuing the policy of taking what it seems possible to work into their schedules, at prices ranging from 2.50c. for shapes to 4c. for plates, although it is probable that every mill of consequence will find itself oversold for the last half, if not well through the first quarter of 1917. The buying of track fastenings by the railroads runs into large figures, one interest taking a total of 35,000 tons last week, a part of it for 1917 delivery at prices which, for spikes and bolts, show an advance of $3 per ton. Users of rail-steel bars are now making contracts for the last half on the basis of 2.50c., Chicago. Shipments of steel in the aggregate in the current month promise to exceed all previous records, the leading interest already surpassing its high record of March. In pig iron, activity has been at a minimum. One interesting phase attendant upon the sharp reduction in ocean freights has been the increase in export inquiry. Lower quotations for scrap

are the rule, the necessities of the dealers in moving materials on track resulting in exceptionally low prices.

Pig Iron.—A week of exceeding quiet has been the experience of all sellers and the few transactions that are reported change the complexion of the market but little. While there is no more demand for Northern than for Southern iron, the desire to sell the latter appears to be decidedly more urgent, and the evidences of weakness which can be had from quotations have to do almost entirely with Southern iron. The market is such that a concession in price means a quotation for Southern iron below $15, Birmingham, for No. 2, and the securing of anything above that price would be exceptional. Sales of spot iron of analysis corresponding to No. 1 grading have been made on the basis of $15.50, Birmingham. The only sale of any size reported by a Northern furnace was of 600 tons of high-sulphur charcoal iron, the price being equivalent to $17 at furnace. Ohio high-silicon irons appear to be considered disproportionately high in price, and it is noted that some Bessemer ferrosilicon is to be had on the basis of $33.50, Chicago. The sale of the Iroquois Iron Company to the By-Product Coke Corporation was consummated last week. For Lake Superior charcoal iron we quote delivery prices at Chicago to include a freight rate of $1.75. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5	$19.75
Lake Superior charcoal, No. 1	20.25
Lake Superior charcoal, No. 6 and Scotch	20.75
Northern coke foundry, No. 1	19.50
Northern coke foundry, No. 2	19.00
Northern coke foundry, No. 3	18.50
Southern coke, No. 1 f'dry and 1 soft	$19.50 to 20.00
Southern coke, No. 2 f'dry and 2 soft	19.00 to 19.50
Malleable Bessemer	19.50
Basic	19.00 to 19.50
Low phosphorus	34.00 to 36.00
Silvery, 8 per cent	31.50
Bessemer ferrosilicon, 10 per cent	33.50 to 35.50

Rails and Track Supplies.—Further rail purchases are entirely of an incidental nature, aggregate sales of the week running to about 7000 tons. The buying of track fastenings, however, is being continued on a very heavy scale, one interest taking orders for a total of 35,000 tons of spikes, bolts, tie-plates and angle bars, these contracts running through, in a number of instances, the first half of 1917. Quotations are as follows: Standard railroad spikes, 2.75c., base; track bolts with square nuts, 3.25c. to 3.50c., base, all in carload lots, Chicago; tie-plates, $50, f.o.b. mill, net ton; standard section, Bessemer rails, Chicago, $33, base; open hearth, $35; light rails, 25 to 45 lb., $40; 16 to 20 lb., $41; 12 lb., $42; 8 lb., $43; angle bars, 2c., Chicago.

Structural Material.—The extent to which market conditions have curtailed steel construction is clearly apparent in the dearth of recent contracts. The only work of importance closed last week was the addition to Sears-Roebuck & Co.'s plant, calling for 575 tons, to be supplied by the Hansell-Elcock Company, and the addition to the Thomas B. Jeffery Company's works at Kenosha, Wis., for which 500 tons of steel will be fabricated by the Federal Bridge Company. The offering of structural steel by some of the mills for last half delivery, which within the past few weeks has given rise to an impression of easier mill conditions, now appears to be very limited in its scope. In advising the trade of their willingness to accept specifications, 2.50c., Pittsburgh, was named as the price for both Bessemer and open-hearth steel. From the outstanding railroad car inquiry, the Illinois Central has again withdrawn its request for prices on 500 stock cars. No new inquiry has materialized. We quote for Chicago delivery of plain material from mill 2.689c.

We quote for Chicago delivery of structural steel from jobber's stock 3.10c.

Plates.—Recent quotations by Pittsburgh mills to Western trade are on the basis of 2.75c., Pittsburgh, for universal mill plates and 2.90c. for sheared plates, for specifications to be filled at mill convenience in the second half. This contrasts with orders taken at Chicago, for export, and for third quarter delivery, on the basis of 3.50c., and even as high as 4c. The spread in prices cannot be considered as indicative of any weakness in the situation, but as arising from differences in delivery requirements. We quote for Chicago delivery of plates from mill on contracts 3.089c., and for prompt shipment 3.60c. to 4.89c.

We quote for Chicago delivery of plates out of jobbers' stock 3.50c.

Sheets.—The softness of the market with respect to sheets of No. 16 gage and lighter, particularly one-pass sheets, is still conspicuous as an exception to the general strength of finished steel products. For gages heavier than No. 14 the quotations indicate a uniformly strong position on the part of the mills. A sale of No. 14 sheets at 3.15c., Chicago, equivalent to 2.90c., Pittsburgh, is noted, but for one-pass sheets of average width in the lighter gages 3.75c., Pittsburgh, has been done. We quote for Chicago delivery, blue annealed, No. 16 and heavier, 3.089c. to 3.189c.; box annealed, No. 17 and higher, 3.089c. to 3.189c.; No. 28 galvanized, 5.039c. to 5.089c.

We quote for Chicago delivery of sheets out of stock, minimum prices applying on bundles of 25 or more, as follows: No. 10 blue annealed, 3.40c.; No. 28 black, 3.10c. to 3.20c.; No. 28 galvanized, 5.40c. to 5.50c.

Bars.—Mills rolling rail-steel bars are now taking on contracts for the last half requirements of their customers on the basis of 2.50c., at Chicago mill. Reports of lower prices applicable to last half purchases of mild steel bars appear to be traceable to sales of bars rolled from special analysis billets. In a number of instances apparent weaknesses in connection with sales of semi-finished steel may be attributed to like circumstances, where rejected billets intended for ammunition steel, and for ordinary uses high in carbon, have been offered at concessions. At Chicago billets of this kind are being offered at $40 per ton. Bar-iron mills report a slight decline in their bookings of both specifications and new business, but, being already oversold for some weeks to come, this condition is rather welcome than otherwise. We quote, mill shipment, Chicago, as follows: Bar iron, minimum, 2.35c.; soft steel bars, 2.689c.; nominal on contracts, 3.18c. for prompt shipment; hard steel bars, 2.50c. to 2.75c.; shafting, in carloads, 20 per cent off; less carloads, 15 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 3.10c.; bar iron, 3.10c.; reinforcing bars, 3.10c., base with 5c. extra for twisting in sizes ½ in. and over and usual card extras for smaller sizes; shafting 10 per cent above list.

Rivets and Bolts.—Important inquiry for bolts and nuts continues to come from manufacturers despite the high level of prices and the long delays in delivery. Quotations on business from industrial consumers show markedly fewer departures from regular schedules than has been true in connection with recent railroad business now largely closed for the ensuing contract period. For these latter contracts prices were made in a number of instances at considerable concessions. We quote carriage bolts up to ⅝ x 6 in., rolled thread, 50-10-5; cut thread, 50-5; larger sizes, 40-5; machine bolts up to ⅝ x 4 in., rolled thread, with hot pressed square nuts, 50-10-10; cut thread, 50-10; larger sizes, 40-10-5; gimlet point coach screws, 60; hot pressed nuts, square, $2.90 off per 100 lb.; hexagon, $2.90 off. Structural rivets, ¾ to 1¼ in., 3.50c. to 3.75c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

We quote out of store: Structural rivets, 3.50c.; boiler rivets, 3.60c.; machine bolts up to ⅝ x 4 in., 60-10; larger sizes, 50-10; carriage bolts up to ⅝ x 6 in., 60-5; larger sizes, 50 off; hot pressed nuts, square, $3.25, and hexagon, $3.25 off per 100 lb., lag screws, 65.

Wire Products.—The diminishing volume of domestic business in fencing and barb wire is still to be noted, as well as the continued demand for nails and plain wire. No announcement is as yet forthcoming regarding further advances in prices, and there is much evidence that many producers are averse to such increases. Some new inquiry for barb wire for export has been received. We quote as follows: Plain wire, No. 8 and coarser, base, $2.639; wire nails, $2.689; painted barb wire, $2.839; galvanized barb wire, $3.539; polished staples, $2.839; galvanized staples, $3.539, all Chicago.

Cast-Iron Pipe.—The leading interest has taken the order for 1800 tons of pipe for Newton, Kan., and also for about 200 tons for Fargo, N. D. In the current week the only inquiries of importance are for 500 tons at Oskaloosa, Kan., and 210 tons at Morris, Minn. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $33.50 to $34; 6 in. and larger, $30.50 to $31, with $1 extra for class A water pipe and gas pipe.

Old Material.—Even more radical reductions in prices of scrap than had been made appear to have been brought out in the last week. Some of the specialties, in particular, show marked weakness, steel axles having been bought for resale at $25.50 per gross ton, while steel angle bars were sold to a consumer as low as $14.35. A number of carloads of machine shop turnings went to a local melter at $6. The needs of consumers appear to be very limited, most of them being able to secure what they require by taking advantage of forced sales of carload lots on track. Railroad offerings of scrap in the week include 5500 tons from the Illinois Central and 4000 tons from the Chicago & Northwestern. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton

Old iron rails	$17.50 to $18.00
Relaying rails	19.50 to 20.50
Old carwheels	12.75
Old steel rails, rerolling	16.75 to 17.25
Old steel rails, less than 3 ft	16.50 to 17.00
Heavy melting steel scrap	15.50 to 16.00
Frogs, switches and guards, cut apart	15.50 to 16.00
Shoveling steel	14.50 to 15.00
Steel axle turnings	10.25 to 10.75

Per Net Ton

Iron angles and splice bars	$18.25 to $18.75
Iron arch bars and transoms	19.50 to 20.00
Steel angle bars	14.50 to 14.75
Iron car axles	23.25 to 23.75
Steel car axles	22.75 to 23.25
No. 1 railroad wrought	15.75 to 16.00
No. 2 railroad wrought	14.50 to 14.75
Cut forge	14.50 to 14.75
Pipes and flues	11.50 to 12.00
No. 1 busheling	13.00 to 13.50
No. 2 busheling	9.00 to 9.50
Steel knuckles and couplers	15.00 to 15.25
Steel springs	15.75 to 16.00
No. 1 boilers, cut to sheets and rings	10.50 to 11.00
Boiler punchings	14.00 to 14.50
Locomotive tires, smooth	19.50 to 20.00
Machine shop turnings	6.00 to 6.50
Cast borings	6.25 to 6.50
No. 1 cast scrap	12.00 to 12.25
Stove plate and light cast scrap	10.00 to 10.50
Grate bars	10.25 to 10.50
Brake shoes	10.25 to 10.75
Railroad malleable	12.50 to 13.00
Agricultural malleable	11.00 to 11.50

Philadelphia

PHILADELPHIA, PA., May 31, 1916.

The steel mills are continuing their endeavor to shorten their deliveries, but with some, notably those specializing in plates, the attempt is futile. The best they can do is to keep even with unfilled orders. One leading plate maker finds orders accumulating despite the many that are declined. Prices continue strong for the most part, but a little easiness is noted in billets and structural shapes, one mill finding some difficulty in getting for the latter 3.159c., Philadelphia. With the mills so well filled up, however, this tendency is almost negligible. In billets, the slightly softer market is due in some degree to the freer offerings of discarded shell steel, which, in the form of blooms, is moving rather slowly. The round discarded steel is finding a good market. A steel plant in the East has purchased several thousand tons of basic pig iron; it is reported that Southern iron was taken. More is wanted. Foundry pig iron is dull, but makers are well occupied in filling contracts. Spot ferromanganese of domestic manufacture is easier. The old material market continues to sag in the absence of buying.

Pig Iron.—The reference made a week ago to business in basic concerned the purchase by a steel company in the East of several thousand tons, reported as 20,000, and it is said that at least as much more is desired. Officially nothing is being said by the buyer, but it is understood that Southern iron was bought, and at a price near $19.68, delivered, including rail and water freight, the latter from Norfolk. No other business in basic is reported. The Berks County, Pa., foundry, also referred to a week ago, as taking 3500 tons of first-half foundry iron, contracted altogether for about 4500 tons at a price something under $20.50, delivered. The Lenoir City Car Works is in the market for about 1650 tons, including some charcoal iron, for delivery in the last half. Because of the location of this consumer, Southern iron probably will be purchased. Taken as a whole the foundry iron market is dull, but the producers' quotations remain firm at $20.50 to $21, delivered, for eastern Pennsylvania No. 2 X. Strikes in consumers' plants have in some instances caused iron to be sold a second time, and sometimes at concessions, but there have been few such troubles in the foundries of this territory. A considerable part of the trade is convinced that a shortage of spot iron is not remote. Makers of standard low phosphorus are busy in making deliveries, and are being urged by their customers to ship with the least possible delay. Quotations for standard brands, delivered in buyers' yards, prompt shipment, range about as follows.

Eastern Pa., No. 2 X foundry	$20.50 to $21.00
Eastern Pa., No. 2 plain	20.25 to 20.75
Virginia, No. 2 X foundry	21.25
Virginia, No. 2 plain	20.75
Gray forge	19.50
Basic	20.50 to 21.00
Standard low phosphorus	34.00 to 35.00

Iron Ore.—In the week ended May 27 there arrived at this port 15,300 tons from Cuba. Should the movement of Lake Superior ore fall seriously short of expectations, importers of foreign ore look for a revival of activity in their business, to a moderate extent, at least.

Ferroalloys.—The market for spot 80 per cent ferromanganese of domestic manufacture continues to grow easier. The spot price is about $250, seaboard, but it is believed that this figure could be shaded. For August delivery $210 has been quoted, and a sale of December has been made at $175. Quotations for English 80 per cent are unchanged at $200 for last quarter, and $175 for first half. The English producers are not much concerned at what price the domestic makers dispose of prompt material, inasmuch as they have no spot or nearby to offer, but they do not want to see any radical cutting of prices for future deliveries. Sales of spiegeleisen, containing 16 to 20 per cent manganese, for June and July delivery, are reported at $58 to $60, furnace, although makers are still asking $60, furnace, for last half. Contract ferrosilicon, 50 per cent, is unchanged at $83 to $85, Pittsburgh, according to quantity; 10 per cent is quoted at $34.44, delivered, and 11 per cent at $35.44.

Plates.—It can only be reiterated that the plate market is strong, more so than that for steel bars and shapes, and the mills are receiving specifications faster than they can turn out material. Some of the orders cannot be filled until February. The number of locomotives for which plates will be required aggregates several hundred. Two large makers continue to ask 4c., Pittsburgh, or 4.159c., Philadelphia, but 3.909c., Philadelphia, can be done. Odd lots, shipped promptly, continue to command 5.50c., Eastern mill.

Bars.—Most of the larger mills are out of the market so far as new business in steel bars is concerned, and the demand is being supplied by rerolling mills, which are utilizing discard shell steel to a large extent. The nominal quotation for steel bars is unchanged at 2.909c., Philadelphia. Iron bars are strong at 2.659c., Philadelphia, carload lots.

Structural Material.—Conditions differ according to makers, although there is no question as to the heavy demand for some sizes and the shortage of them. The big bridge shops are not as busy as they would like to be, but other fabricators are taking shipments at a rate which keeps the mills in distress. Jobbers are short of such sizes as 4, 5, 6 and 8 in. channels and 3 x 3-in., and smaller, angles. While one maker declares it not altogether easy to obtain 3.159c., Philadelphia, another is getting all of the business at this price that it can handle. The export demand is heavy, and in this connection it may be said that the mills deserve credit for what they are doing in taking care of domestic con-

sumers, inasmuch as they could sell their unfinished steel without difficulty and at good prices to foreign consumers. Some shapes which are going to an English shipyard at Hong Kong, China, will cost the buyers over 5c. Shipyards are so eager for material that they are taking ordinary shapes in lieu of ship specials.

Billets.—The general situation is unchanged, the mills continuing to quote open-hearth rerolling billets at about $50 and forging steel at $65. A mill making plates in this district which was short of steel bought about 10,000 tons from a competitor. Blooms of discarded shell steel are not moving with the facility of discarded shell rounds. The foreign demand for unfinished steel is heavy.

Sheets.—Eastern Pennsylvania makers continue to quote No. 10 blue annealed sheets at 3.909c. to 4.159c., Philadelphia.

Coke.—The market is quiet and shows an easier tendency. Spot furnace is quoted at $2.25 to $2.50 per net ton at oven, and contract at $2.50 to $2.75. Spot foundry is quoted at $3.25 to $3.50 per net ton at oven and contract foundry at $3.50 to $3.75. Freight rates from the principal producing districts are as follows: Connellsville, $2.05; Latrobe, $1.85, and Mountain, $1.65.

Old Material.—Except that the embargo against one or two plants, notably one at Coatesville, has been lifted, the situation is unchanged. The market is at a standstill and growing weaker. While heavy melting steel is quoted around $16, deliveries are still to be made on material which was bought at $18 and upward. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania, and taking freight rates from 35c. to $1.35 per gross ton, are as follows:

No. 1 heavy melting steel	$16.00 to $16.50
Old steel rails, rerolling	18.00 to 19.00
Low phos. heavy melting steel scrap	22.50 to 23.25
Old steel axles	26.00 to 27.00
Old iron axles	28.00 to 29.00
Old iron rails	20.00 to 20.50
Old carwheels	16.50 to 17.00
No. 1 railroad wrought	22.00 to 22.50
Wrought-iron pipe	13.25 to 13.75
No. 1 forge fire	14.50 to 15.00
Bundled sheets	14.50 to 15.00
No. 2 busheling	11.00 to 11.50
Machine shop turnings	9.00 to 9.50
Cast borings	10.00 to 10.50
No. 1 cast	17.50 to 18.00
Grate bars, railroad	13.50 to 14.00
Stove plate	13.00 to 13.50
Railroad malleable	14.50 to 15.00

Cleveland

CLEVELAND, OHIO, May 30, 1916.

Iron Ore.—A leading shipper has chartered some vessel capacity for ore at $1 a ton, exclusive of the 10-cent unloading charge, from the head of the Lakes, or double the contract rate. Since the rush of early chartering there has been little activity in the vessel market, the large ore firms being well covered and most of the ore being moved so far in contract boats. However, some tonnage was taken a few weeks ago at an advance over regular rates. Some has also just been placed for ore for shipment from Escanaba to South Chicago at 60c. a ton or double the contract rate. The additional carrying charges will doubtless, in most cases, be carried by the consumers. During the ore buying movement sellers were careful not to make sales in excess of vessel space for which they had covered and some of the late contracts provided that in case of an advance in the carrying charges the excess should be paid by the furnace company. We quote prices as follows, delivered lower Lake ports. Old range Bessemer, $4.45; Mesaba Bessemer, $4.20; Old range non-Bessemer, $3.70; Mesaba non-Bessemer, $3.55.

Pig Iron.—The market is dull. A few sales of foundry iron are being made for the first half, but there is practically no inquiry for shipment this year. A number of inquiries for Bessemer iron for export in lots of 10,000 to 15,000 tons have come from brokers. Among the sales reported is a round lot of foundry iron for first half delivery to a Michigan foundry making automobile castings. A Dayton, Ohio, manufacturer has taken from a Lake furnace 600 tons of No. 1 foundry iron at $19 for first half delivery. Recent quotations by a Cleveland furnace of $18.50 for No. 2 for outside shipment and $19 at furnace for Cleveland delivery are being maintained in spite of lower prices that are coming out in the Valley. However, no inquiries of sufficient size developed during the week to test the prices and some of the Valley furnaces are refusing to shade the $18.50 price. Southern foundry iron is very dull. A few sales are reported in lots of 200 tons and under. Furnace quotations are unchanged at $15, Birmingham, for No. 2 for this year's delivery, which can probably be shaded slightly, and $15.50 for the first half, but resale iron can still be had around $14.50. Ohio silvery prices are not as firm as they have been, due to the competition of Tennessee silvery iron, some of which has been sold delivered in Cleveland at $26 for 6 per cent. We quote, delivered Cleveland, as follows:

Bessemer	$21.95
Basic	$18.95 to 19.30
Northern No. 2 foundry	19.00 to 19.30
Southern No. 2 foundry	18.50 to 19.50
Gray forge	18.75
Jackson Co. silvery, 8 per cent. silicon	28.62 to 30.62
Standard low phos., Valley furnace	32.00

Coke.—The shortage of labor in foundries has prevented some plants from using their coke as fast as contracted for and this has caused a surplus of foundry coke for prompt shipment. There is no activity in the market. We quote standard Connellsville foundry coke at $3 to $3.50 per net ton at oven for prompt shipment and $3.50 for contracts.

Bolts, Nuts and Rivets.—The demand for bolts and nuts continues very heavy and makers are getting further behind on deliveries owing to the delay in getting started and to the labor shortage, the scarcity of labor having curtailed production considerably. Considerable business is being placed in contracts at the recent advance in prices. Rivet specifications are very heavy, but no contract business is reported since the last price advance of $5 per ton. Bolt and nut discounts are as follows:

Common carriage bolts, ⅝ x 6 in., smaller or shorter, rolled thread, 50 and 10; cut thread, 50; larger or longer, 40; machine bolts with h. p. nuts, ⅝ x 4 in., smaller and shorter, rolled thread, 50, 10 and 5; cut thread, 50 and 5; larger and longer, 40 and 10; lag bolts, gimlet or cone point, 50 and 10; square h. p. nuts, blank or tapped, $2.90 off the list; hexagon, h. p. nuts, blank or tapped, $2.90 off; c. p. c. and t. square nuts, blank or tapped, $2.60; hexagon nuts, all sizes, $3 off; cold pressed semi-finished hexagon nuts, all sizes, 60 and 10.

Finished Iron and Steel.—While specifications are heavy the volume of current orders for either prompt shipment or delivery at the convenience of the mills has fallen off somewhat. Some contracts for steel bars, plates and structural material are being closed for third quarter and last half delivery, and considerable inquiry is pending for steel for last half from consumers who were previously unable to cover for as much as they wanted for those deliveries. Some inquiries on these materials are coming out for first half of next year but so far mills are refusing to quote for that delivery. One mill that had some Bessemer steel bars to offer for prompt shipment is finding no difficulty in selling this steel at 3c. and has taken one lot of 1000 tons for a Toledo maker of automobile parts. An Eastern mill that has been quoting forging billets at $65, Pittsburgh, is now offering to take on its regular trade at that price for fourth quarter delivery. The demand for plates continues active, although the volume of business in the lighter gages is only moderate. Tank and boiler shops are not crowded to capacity and some are not specifying the full tonnage they have under contract. Local plate prices are unchanged at 3.50c. to 4c., Pittsburgh. Little new structural work is coming out. One new inquiry is for 300 tons for an addition to the Union Club, Cleveland. There is a fair demand for structural material for prompt shipment which is quoted at 3c., Pittsburgh, in Bessemer steel. The demand for hard steel bars for reinforcing purposes is fairly active and sales aggregating 1600 tons for prompt shipment are reported by an Illinois mill at 2.25c. or a delivered Cleveland price of 2.47c. Iron bars are quoted at 2.45c. to 2.60c., Cleveland. The demand for sheets continues fairly good, being heavy for blue annealed sheets. Some black sheets are still being sold below regular quotations. We quote black

sheets at 2.90c. to 3c. for No. 28; blue annealed at 3c. to 3.25c. for No. 10, and galvanized at 4.85c. to 5c. for No. 28. Warehouse prices are unchanged at 3.25c. for steel bars and structural material; 3.65c. for plates and 3.20c. for iron bars.

Old Material.—The market continues lifeless, but dealers look for more activity shortly as the stocks of some consumers are understood to be running low. Dealers are unwilling to sell short at present prices, and mills are unwilling to pay the advance. Owing to the scarcity of labor some mills are placing as little scrap as possible in the yards and unloading the material that comes in into their charging boxes, thus saving rehandling. Heavy steel is quoted nominally at $16, Cleveland, but dealers want about 50c. more for round tonnages. A local mill has taken some No. 1 busheling at $13.50. We quote f.o.b. Cleveland as follows:

Per Gross Ton

Old steel rails	$16.00 to $16.25
Old iron rails	19.00
Steel car axles	28.00 to 29.00
Heavy melting steel	16.00
Old carwheels	13.50 to 13.75
Relaying rails, 50 lb. and over	22.50
Agricultural malleable	13.00 to 13.25
Railroad malleable	15.75 to 16.00
Steel axle turnings	13.00 to 13.25
Light bundled sheet scrap	13.00 to 13.25

Per Net Ton

Iron car axles	$23.00 to $24.00
Cast borings	7.25 to 7.50
Iron and steel turnings and drillings	7.50
No. 1 busheling	13.50 to 14.00
No. 1 railroad wrought	17.00 to 17.50
No. 1 cast	14.00 to 14.25
Railroad grate bars	11.75 to 12.00
Stove plate	11.25 to 11.50

Buffalo

BUFFALO, N. Y., May 30, 1916.

Pig Iron.—Inquiry has fallen behind the average for the past month or six weeks. Users' requirements are pretty well covered for the time being, and consumption is curtailed in some sections due to labor troubles. Heavy shipments are now going forward on the Erie Canal to New England and seaboard points. The range of prices is about the same as reported last week, some furnaces quoting a little under 1916 schedules for 1917 deliveries on such business as they are accepting for next year's shipment. For No. 2X, $19, furnace, is apparently the minimum for 1916 delivery, but it is stated one producer has taken on first-half 1917 delivery at $18.50 for equivalent to this grade. The Port Colborne furnace of the Canadian Furnace Company went into blast last week after relining. We quote, f.o.b. furnace, Buffalo, for current and last half, with some deliveries extending into first half, 1917, as follows:

No. 1 foundry	$19.00 to $20.00
No. 2 X foundry	18.50 to 19.00
No. 2 plain	18.25 to 18.75
No. 3 foundry	18.25 to 18.75
Gray forge	18.00 to 18.50
Malleable	18.50 to 19.00
Basic	19.00 to 19.50
Bessemer	21.00 to 22.00
Charcoal, regular brands and analysis	21.00 to 22.00

Finished Iron and Steel.—Some buying is going on for material needed for the remainder of the year, but buyers are becoming a little more conservative as regards forward commitments, being content to provide for their this year's requirements. A number of inquiries for wire rods are unsatisfied, one for 1000 tons and one for 100 tons. It is reported that Canadian manufacturers of wire products and nails are running night and day, largely on export shipment orders of nails and barbed wire for Great Britain and the other Allies. Their output is restricted only by ability to secure rods. It is understood that about 1000 tons of structural material and plates required for the T. Eaton & Sons, Ltd., warehouse and manufacturing plant extensions in Toronto has been placed at premium prices for delivery within the next sixty days. Cold-drawn steel is held at a minimum of 15 per cent off the list for carloads and larger quantities for third and fourth quarters. Some sellers quote only 10 per cent off; mills are not accepting business beyond Jan. 1, most orders accepted being for third-quarter delivery. Bids are in for 150 tons of structural steel for the Friendly Home Society, Rochester, and for 700 tons for two highway bridges over the Erie Canal. Revised bids are being taken this week on 150 tons for a high school at Kenmore, N. Y.

Old Material.—Only a small amount of new business is being transacted except in turnings, in which a fair movement is noted owing to the lifting of the embargo at Brackenridge. Prices in this commodity have stiffened. Some large amounts of turnings were placed prior to the recent general price softening, against which dealers are still shipping. Dealers expect the market will improve within the next few weeks. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	$17.00
Low phosphorus steel	$20.00 to 20.50
No. 1 railroad wrought scrap	19.00 to 19.50
No. 1 railroad and machinery cast scrap	16.00 to 16.50
Old steel axles	24.00 to 24.50
Old iron axles	24.00 to 24.50
Old carwheels	14.00 to 14.50
Railroad malleable	15.50 to 16.00
Machine shop turnings	8.00
Heavy axle turnings	12.00
Clean cast borings	9.25 to 9.50
Old iron rails	18.00 to 18.50
Locomotive grate bars	12.00 to 12.50
Stove plate (net ton)	11.50 to 12.00
Wrought pipe	14.00 to 14.50
Bundled sheet scrap	12.50 to 13.00
No. 1 busheling	14.50
No. 2 busheling	11.50
Bundled tin scrap	15.00 to 15.50

Cincinnati

CINCINNATI, OHIO, May 31, 1916.—(*By Wire.*)

Pig Iron.—Only a few scattered sales are reported. A consumer in southern Ohio bought 600 tons of Southern foundry iron and an Indiana melter took 500 tons, both for last half shipment. The carload business is much below normal. Southern prices are soft, and $15, Birmingham, for shipment in the first half of next year can be done with more than one furnace. Some foundry iron has also sold at $14.75, with shipments extended into the first quarter of 1917, but this is said to be analysis iron not strictly up to No. 2 foundry. Northern furnaces have not yet made any attempt to meet Southern competition, and furnace iron is held at $19, Ironton, for any shipment up to July 1 of next year. However, resale iron is still obtainable at $18.50 for this year's movement. General inquiries are about as scarce as sales, and very few consumers are evincing any interest in the market's future, awaiting developments before asking for prices on any large tonnages for next year. A central Ohio firm will buy soon 1000 tons of Southern foundry iron for shipment in the last half of this year. A central Ohio manufacturer wants 500 tons of either Northern or Southern foundry for the same delivery and an inquiry from Michigan calls for 1000 tons. The Ohio silvery iron situation is unchanged, and all the way from $27 to $29 at furnace is quoted, the first named figure representing the market price for this year. Nothing has been heard of malleable or basic lately, and it is understood that melters of these two irons have contracted for sufficient quantities to carry them well into next year. The melt of foundry iron in this vicinity is very good, and even the stove foundries are consuming a fair average. Based on freight rates of $2.90 from Birmingham and $1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft	$18.40 to $18.90
Southern coke, No. 2 f'dry and 2 soft	17.90 to 18.40
Southern coke, No. 3 foundry	17.40 to 17.90
Southern coke, No. 4 foundry	16.90 to 17.40
Southern gray forge	16.40 to 16.90
Ohio silvery, 8 per cent silicon	28.26 to 28.76
Southern Ohio coke, No. 1	21.26
Southern Ohio coke, No. 2	20.26
Southern Ohio coke, No. 3	19.76
Southern Ohio malleable Bessemer	20.26
Basic, Northern	20.26
Lake Superior charcoal	21.20 to 22.20
Standard Southern carwheel	24.90 to 25.40

(*By Mail*)

Finished Material.—The jobbing houses report a fairly good business in reinforcing concrete rods, and the demand for different kinds of structural material is improving. The mill and factory supply business is

also good. Jobbers in builders' hardware report an advance this week of 10 per cent on hinges, butts, etc. We quote store prices as follows: Wire nails, $2.75 per keg, base; barb wire, 3.60c. per 100 lb.; No. 10 blue annealed sheets, 3.50c.; small structural shapes, 3.20c. Jobbers are quoting the small sizes of machine bolts at 60 per cent off list; larger sizes, 40 and 10 and 5 per cent off; carriage bolts, smaller sizes, 50 and 10 and 5 per cent off; larger sizes, 40 and 5 per cent. The mill price of No. 28 galvanized sheets is unchanged at 5.15c., Cincinnati or Newport, Ky., and from 3.15c. to 3.20c. for No. 28 black sheets.

Coke.—Prices on prompt coke in the Connellsville district are soft. This applies to both furnace and foundry coke for near-by shipment. Contract figures are around $2.35 to $2.50 per net ton at oven for 48-hr. coke and from $3.40 to $3.60 for foundry coke. Some spot shipment of 48-hr. brands can be obtained at $2.25 and some foundry coke at $3.25. Wise County and Pocahontas operators are naming prices about 25c. per ton higher and New River foundry coke is quoted at $4 to $4.25 at oven, but very little business of any character is reported by the different selling agencies.

Old Material.—The demand for nearly all grades of scrap is slow. Reports from dealers all indicate that prices are not firm, but no general reductions have been reported. The following are dealers' prices to consumers, f.o.b. at yards, southern Ohio and Cincinnati:

Per Gross Ton

Bundled sheet scrap	$11.75 to $12.25
Old iron rails	15.75 to 16.25
Relaying rails, 50 lb. and up	21.25 to 21.75
Rerolling steel rails	15.00 to 15.50
Heavy melting steel scrap	14.25 to 14.75
Steel rails for melting	13.50 to 14.00

Per Net Ton

No. 1 railroad wrought	$13.50 to $14.00
Cast borings	5.50 to 6.00
Steel turnings	5.50 to 6.00
Railroad cast scrap	11.25 to 11.75
No. 1 machinery scrap	13.00 to 13.50
Burnt scrap	8.25 to 8.75
Iron axles	20.25 to 20.75
Locomotive tires (smooth inside)	18.00 to 18.50
Pipes and flues	9.75 to 10.25
Malleable and steel scrap	11.00 to 11.50
Railroad tank and sheet scrap	8.75 to 9.25

St. Louis

ST. LOUIS, MO., May 29, 1916.

Pig Iron.—The impression seems to be that no very large new buying will be seen before the turn of the half year. One sale of 10,000 tons of basic Northern was reported and also one of 1000 tons of carwheel iron, while an inquiry for another 1000-ton lot of carwheel iron remains unfilled. An interesting development is the utilization of water transportation, a water and rail route for some few furnaces in the South having been devised with the result that these furnaces can lay down pig iron in the St. Louis district at $1 to $1.10 per ton saving over the all-rail rate. While consumers are not getting all the benefit of this, it is enabling some furnaces to meet competition without losing profits. Most melters in the St. Louis district are reported as preferring to run on their supplies in the yard and en route to clear up interest and other charges, knowing that the ultimate consumer will have to pay the price on any new business, as all current contracts for castings, etc., are apparently covered. Prices are unchanged.

Coke.—Business continues in small lots. By-product coke is selling on the Connellsville basis with very little doing, as supplies are apparently well sold up for the remainder of the year and no next year business is being booked.

Finished Iron and Steel.—In standard section steel rails a sale of 2000 tons was made, while in light rails 6½ miles of 20-lb. rails were sold at the last advance. Movement out of warehouse is active at these quotations: Soft steel bars, 3.15c.; iron bars, 3.10c.; structural material, 3.15c.; No. 10 blue annealed sheets, 3.45c.; tank plate, 3.55c.; No. 28 black sheets, cold rolled, one pass, 3.30c.; No. 28 galvanized sheets, black sheet gage, 5.55c.

Old Material.—Scrap has softened as a result of the continued embargoes and refusal of mills and foundries to buy, as well as in some case to receive specifically contracted material. All consumers apparently are determined to run down their supplies materially before buying further. Relaying rails are actively in demand and well held at quotations. The only list out was one of 2000 tons from the Vandalia. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton

Old iron rails	$16.75 to $17.25
Old steel rails, re-rolling	15.75 to 16.25
Old steel rails, less than 3 ft	16.25 to 16.75
Relaying rails, standard section, subject to inspection	22.00 to 23.00
Old carwheels	11.75 to 12.25
No. 1 railroad heavy melting steel scrap	15.75 to 16.25
Heavy shoveling steel	12.50 to 13.00
Frogs, switches and guards cut apart	14.75 to 15.25
Bundled sheet scrap	9.75 to 10.25

Per Net Ton

Iron angle bars	$15.75 to $16.25
Steel angle bars	13.25 to 13.75
Iron car axles	23.25 to 23.75
Steel car axles	24.75 to 25.25
Wrought arch bars and transoms	19.00 to 19.50
No. 1 railroad wrought	15.25 to 15.75
No. 2 railroad wrought	15.00 to 15.50
Railroad springs	13.75 to 14.25
Steel couplers and knuckles	13.75 to 14.25
Locomotive tires, 42 in. and over, smooth inside	18.75 to 19.25
No. 1 dealers' forge	10.25 to 10.75
Mixed borings	6.25 to 6.75
No. 1 busheling	12.75 to 13.25
No. 1 boilers, cut to sheets and rings	9.00 to 9.50
No. 1 railroad cast scrap	11.75 to 12.25
Stove plate and light cast scrap	8.75 to 9.25
Railroad malleable	11.00 to 11.50
Agricultural malleable	10.00 to 10.50
Pipes and flues	10.25 to 10.75
Railroad sheet and tank scrap	9.50 to 10.00
Railroad grate bars	8.75 to 9.25
Machine shop turnings	7.25 to 7.50

Birmingham

BIRMINGHAM, ALA., May 29, 1916.

Pig Iron.—The Birmingham district iron makers did not sell their entire May output, but shipping orders for June are largely in excess of the make, being 100 per cent over in one instance. The resuming furnace at Anniston, which expects to go in July 1, has offered a limited amount of iron for last half at $15. It is presumed this is in order to enter the market, procedure thereafter to be governed by regular market basis. Birmingham operators say they will not be affected and decline to mark down. A 5000-ton lot for spot delivery at $15 was the largest transaction of the week, and numerous orders for spot of 200 to 1000 tons were booked. Very little forward business was heard of. A concern asking $15.50 for both deliveries sold practically none. What forward business was entered by strictly Birmingham furnaces went at $15.50. The test of forward delivery will come soon. The leading interest is among those holding at $15.50 for second half of 1916 and the first half of 1917. The City stack of the Sloss-Sheffield Company goes in July 1. Vanderbilt stack of the Woodward Company, a small furnace, goes in June 10, but a larger one goes out. On July 1 the largest Woodward stack goes on basic for the rest of the year with orders booked to capacity—400 tons daily. The Sloss-Sheffield's new Sheffield stack goes in around August 1 at the same time as the Alabama Company's Gadsden stack, but the twin Sheffield stack goes out. Figuring on this schedule shows a net gain of two foundry stacks and one basic for the last half. It is probable that a small stack in the Birmingham district will, under plans now approaching perfection, go on basic manufactured from concentrated ore. The Sloss-Sheffield Company is shipping 5000 tons per month from Sheffield and Florence by barge line to Paducah for St. Louis, Chicago and Northwestern territory at greatly reduced freight rates. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	$15.50 to $16.00
No. 2 foundry and soft	15.00 to 15.50
No. 3 foundry	14.50 to 15.00
No. 4 foundry	14.25 to 14.75
Gray forge	14.00 to 14.50
Basic	15.00 to 15.50
Charcoal	22.00 to 22.50

Coal and Coke.—The coal market has been doubly stimulated. The Government has awarded contracts to supply naval vessels at New Orleans and Pensacola, while the Southern Pacific, after several years out, re-

entered the Alabama market with an order for 175,000 tons. The mines securing these contracts are in a position to move the output either by rail or water. One other large coal contract secured at a slight advance over last year has been renewed. Coke is very firm and active. Offers of $4.25 per net ton for standard beehive coke have been turned down. The price is $4.50, with very infrequent shadings.

Cast-Iron Pipe.—The pipe market was inactive last week, no large lettings being reported. We quote, per net ton, f.o.b. pipe shop yards, as follows: 4-in., $28; 6-in. and upward, $25, with $1 added for gas pipe and 16-ft. lengths.

Old Material.—The scrap market remains soft. Yards are overflowing. Steel scrap is down a trifle more. Steel axles are strong. We quote, per gross ton, f.o.b. Birmingham yards, price to consumers, as follows:

Old steel axles	$24.00 to $25.00
Old steel rails	12.00 to 12.50
No. 1 steel scrap	10.50 to 11.00
No. 1 wrought scrap	16.00 to 16.50
No. 1 cast scrap	11.00 to 11.50
Extra heavy cast scrap	9.50 to 10.00
Stove plate and light	10.00 to 10.50
Tram carwheels	10.50 to 11.00

San Francisco

SAN FRANCISCO, CAL., May 23, 1916.

Buying in most lines is limited pretty closely to the current year's requirements. Nearly anything that can be offered for immediate delivery, however, finds ready sale at high prices, and practically all tonnage under contract is being specified in full. The general jobbing trade in some quarters is slacking off a little. Inquiries for special work continue fairly numerous.

Bars.—Trade in reinforcing bars holds up in good shape, being affected somewhat by slow deliveries. Distributive business through the country is active. The demand for iron bars for marine work is exceptionally heavy, the local output being limited. Prices for round lots at local mills range from 3.25c. to 3.50c., according to conditions, with delivery in about three months. The jobbing price from store is firm at 4c.

Structural Material.—Building operations are rather below anticipations all along the coast, and comparatively little fabricated material is being used except in bridges and special work. The principal local job placed of late is the 10-story office building for the Southern Pacific Railroad. Dyer Brothers have a good-sized hotel contract for Honolulu, T. H. Plans are under way for a 10-story apartment house at Sutter and Mason streets, and figures are being taken on an addition to the Globe Milling Company's local plant. The Bank & Trust Company of Central California, Fresno, is figuring on a 10-story office building. Specifications for marine and miscellaneous purposes continue heavy.

Plates.—The general distributive trade is hardly as active as a month ago, but is still rather above the average, while the demand from large consumers is about as urgent as ever. Contracts have been placed here for several more tank steamers, and additional marine business is also reported in the north, while the work already in hand has been hampered by shortage of material. The heavy requirements for such work are bringing out some contracts for distant delivery, but on the whole the demand is for early shipment, which is hard to get. Most export inquiries are now going to the mills direct. Small lots from store are quoted at 4.75c.

Sheets.—Galvanized sheets are kept closely cleaned up, as shipments on contracts are coming through slowly. Urgent requirements for manufacturing and building work amount to a very fair tonnage, although the present prices are evidently cutting off much of the ordinary demand. The distributive movement of blue annealed is holding its own, principally being on contracts for special construction and manufacturing.

Wrought Pipe.—Some manufacturers are having the largest oil pipe business for this district in their experience this year, notwithstanding the absence of line pipe orders which have raised the tonnage in former active years. Buying in this department keeps up, but the smaller sizes are falling behind last year.

Cast-Iron Pipe.—There is nothing to report in the way of new municipal contracts, but small purchases for immediate needs are furnishing a satisfactory volume of orders. Prices stand as before at $36 per net ton for 6-in. and over, $39 for 4-in., and $1 extra for class A and gas pipe.

Pig Iron.—The tonnage melted this spring has been exceptionally large. With indications of a continuance of foundry activity on the present scale throughout the year, there is a disposition to make more liberal provision for the future. Several contracts involving a considerable quantity have recently been placed for shipment late in the year. Southern foundry iron is quoted here at $26.50 per gross ton for No. 1 and $26 for No. 2.

Coke.—The assurance that requirements will be no smaller over the remainder of the year is bringing out a few new contracts, and there is also a fair amount of buying for current delivery. Southern foundry coke is quoted here around $15.50 to $16 per net ton.

Old Material.—Notwithstanding the exceptionally large amount of steel scrap melted on this coast the past year, the opinion is expressed in some quarters that a heavy tonnage is being accumulated in the hands of speculators, as it is known that a great deal has come in that has not reached the melters. The recent high prices have brought large shipments from Mexico, China and the Hawaiian Islands, as well as a heavy quantity from isolated points in the interior, where there is a great deal more to be had if needed. According to a recent report, an embargo has been placed on the exportation of scrap from Mexico. The range of $8 to $13 per gross ton still applies to steel melting scrap. Cast-iron scrap continues in good demand, and is firmly held at $16 to $18 per net ton.

The Llewellyn Iron Works, Los Angeles, Cal., has received permission to sell bonds amounting to $350,000, dated Feb. 1, 1916, to mature Feb. 1, 1932, interest 6 per cent, to be sold at a price to net the company at least 95. The proceeds are to be used to erect a new plant at Torrance, near Los Angeles.

New York

NEW YORK, May 31, 1916.

Pig Iron.—New York pig iron sellers have seen the quietest market of the year in the past week. Efforts to uncover business have met with rather meager results. On inquiries for analysis iron there are some indications of the shading of prices ordinarily asked where grades are mentioned. Some Buffalo resale iron is still available and at figures below the quotations commonly mentioned in that district. The sluggish condition of the foundry iron market is seen in the fact that no purchases have been made on a number of inquiries that have been before the market from New Jersey and other nearby districts for the past two weeks. The principal business closed was about 2000 tons of high silicon iron taken by a New Jersey foundry. In New England pig iron supplies are uneven, some foundries having four times their usual stock, while others are nearly bare of iron. Shipments into New England are proceeding, however, though embargoes are still on as against particular towns or plants. Foundries in New York territory and in New England would be consuming more iron but for lack of molders. Sales of Southern warrants have been made below $14, Birmingham. Export firms are continually asking prices on Bessemer iron for shipment to Italy and some business may now result, as vessel owners have come down from the exorbitant prices recently asked. They are willing to carry pig iron to Genoa at $30, and possibly some pig-iron business could be put through with freights at $24 to $25. We quote at tidewater for early delivery: No. 1 foundry, $21 to $21.25; No. 2 X, $20.50 to $20.75; No. 2 plain, $20.25 to $20.50; Southern iron at tidewater, $20.75 to $21 for No. 1 and $20.25 to $20.50 for No. 2 foundry and No. 2 soft.

Ferroalloys.—Ferromanganese sales are less than at any time since the war started and so are inquiries. The alloy can be obtained on contract for $175, seaboard, for delivery in 1917; for $200 for delivery in the last quarter of 1916 and for $225 to $300 for the third quarter of

this year, a sale having been made last week at the latter quotation. Spot material is held as high as $425, with reports that it can be obtained as low as $350. Arrivals are very good, which, with the prospects of larger domestic production in the near future, make for conservatism by consumers. Spiegeleisen is quoted at $60 to $65, furnace, on contract. Ferrosilicon, 50 per cent, is in strong demand at $90 to $100, Pittsburgh, for early delivery and at $83 to $85 on contract. It is reported that a new hydroelectric company is about to produce this alloy in New York State. Ferrotungsten and tungsten metal have eased off, due to lower prices for the ore, and can now be obtained for $7 to $8 per lb. of contained tungsten. Ferrochrome, 60 to 70 per cent, is quoted at 16c. to 20c., New York, per pound of contained chromium. Ferrovanadium is selling at $2.75 to $3, Pittsburgh, per pound of contained vanadium. Ferrotitanium, 15 per cent, is quoted at 8c. per lb., f.o.b. plant, for carload lots; 10c per lb. for ton lots and 12½c. per lb. for small quantities.

Structural Material.—The bulk of new buying still comes from industrial plants for extensions, as has been the case for some time, but sizeable business from the railroads is conspicuous, though totals are not over great. The Alabama Great Southern has closed with the American Bridge Company for a 700-ton bridge; the Central of New Jersey with the McClintic-Marshall Company for 400 tons for that road's central division; the Philadelphia & Reading with the American Bridge Company for 200 tons at Pottstown and the Chesapeake & Ohio has placed a 300-ton bridge contract. The Pennsylvania is in the market for three turntables involving 200 tons, and the Lehigh Valley has taken bids for a 300-ton bridge. Some 4900 tons of New York subway work has been placed with the American Bridge Company, and 250 tons for the Interborough connections with the Queensboro bridge lines has been sublet by the Snare & Triest Company to the McClintic-Marshall Company. The Levering & Garrigues Company is to erect a 250-ton addition for the Walker-Lispenard telephone building and 200 tons for column cores for the Chesebrough Mfg. Company at Perth Amboy. New building work in the market includes 600 tons for a piershed at New London, Conn.; 300 tons for an armory at Rochester, N. Y.; 250 tons for the Kings County court house; 275 tons for a piershed, Noble Street, Brooklyn, for the American Mfg. Company; 300 tons for a crane runway for the Carpenter Steel Company, Reading, Pa., and 2100 tons for a viaduct for Worth Brothers Company, Coatesville, Pa. We quote mill shipments at 2.769c. to 3.169c., New York, depending on the urgency for delivery, and from warehouse at 3.25c. to 3.50c., New York, and for large lots below 3.25c.

Steel Plates.—Export inquiry overshadows domestic demand and some difficulty is met in satisfying it owing to the considerable number of mills which cannot consider the delivery requirements. Much of this is at present for the Orient for shipbuilding and mostly for Japan, and comes from a number of sources. A round tonnage has already been placed for delivery in the last part of the year. Demand for car building is almost negligible, accentuated by the withdrawal again by the Illinois Central of its latest inquiry (and this covering considerable wood in the construction) of 300 box cars. The Pressed Steel Car Company is to build fifteen express cars for the Seaboard. We quote mill shipments at 3.919c., New York, and upward, and such for future business as the mills will consider at 2.919c., New York, and higher. Warehouse prices are 4c. to 4.50c., New York.

Iron and Steel Bars.—Quick deliveries of steel bars continue in Bessemer product at 3c. per pound, Pittsburgh. The chief items of interest in the finished steel market, however, are repeated inquiries for barb wire, each for 150,000 tons for Russia, 30,000 tons of rail blooms for Italy, a pressing foreign demand for the lighter weight sheets and a large inquiry from England for finished large shells. The bar iron market is without significant change. For mill shipments of iron bars we quote 2.669c., New York, and for steel bars 2.769c. to 2.919c., New York, for deferred delivery and 3.169c., New York, for early delivery. Warehouse prices for iron and steel bars are 3.25c. to 3.50c., New York, and for large lots somewhat under these prices.

Cast-Iron Pipe.—Public lettings have been few and far apart for some time. Again, nothing of importance of this character is in sight in this immediate territory. Private buying continues fair in volume. Prices are firm. Carload lots of 6-in., class B and heavier, are maintained at $30.50 per net ton, tidewater, class A and gas pipe taking an extra of $1 per ton.

Old Material.—The market is even more quiet than was reported last week. Heavy melting steel scrap is weaker, due to continued rejections by eastern Pennsylvania steel companies, which cause lower prices among dealers in this vicinity who are obliged to bear the brunt of the scaling down necessary to secure acceptances of cars. So little is doing in other classes of old material that prices may be considered practically nominal. Brokers quote buyers' prices about as follows to local dealers and producers, per gross ton, New York:

Heavy melting steel scrap (eastern Pennsylvania specifications)	$12.50 to $12.75
Old steel rails (short lengths) or equivalent	13.50 to 14.00
Relaying rails	28.00 to 30.00
Rerolling rails	15.50 to 16.00
Iron car axles	26.00 to 27.00
Steel car axles (for domestic use)	28.50 to 29.00
Steel car axles (for export)	30.00
No. 1 railroad wrought	20.00 to 20.50
Wrought-iron track scrap	16.00 to 17.00
No. 1 yard wrought, long	15.00 to 15.50
No. 1 yard wrought, short	13.00 to 13.50
Light iron	6.50 to 7.00
Cast borings (clean)	8.25 to 8.50
Machine-shop turnings	7.50 to 8.00
Mixed borings and turnings	7.00 to 7.50
Wrought pipe	11.00 to 11.50
Old carwheels	15.00 to 15.50
Malleable cast (railroad)	12.25 to 12.75

Cast scrap is in about as little demand as other kinds of old material. Dealers' quotations on cast scrap to consumers are as follows, per gross ton, New York:

No. 1 cast (machinery)	$17.00 to $17.50
No. 2 cast (heavy)	15.50 to 16.00
Stove plate	12.00 to 12.50
Locomotive grate bars	12.00 to 12.50

British Steel Market

More Blast Furnaces to Be Blown In—Export Licenses More Liberal

(*By Cable*)

LONDON, ENGLAND, May 31, 1916.

The pig-iron market is strong, and several more furnaces are to be blown in. No. 3 Cleveland pig iron has sold for shipment at 99s. 6d. Hematite iron is scarce, but export licenses are being issued more freely. Tin plates are firm at 37s. Australia and Japan are inquiring for oil plates. American semi-finished steel has sold for $63, c.i.f. Liverpool, for June delivery. Quotations, mostly nominal, are as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 37s.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £20 5s, against £19 15s last week.

Hematite pig iron, f.o.b. Tees, about 140s.

Sheet bars (Welsh) delivered at works in Swansea Valley, £12 10s.

Steel bars, export, f.o.b. Clyde, £18 5s.

Ferromanganese, £40 to £45 nominal.

Ferrosilicon, 50 per cent, c.i.f., £29.

Pig-Iron Situation Causes Apprehension—Tight Steel Market

(*By Mail*)

LONDON, ENGLAND, May 16, 1916.—General market conditions continue exceedingly tight, the tendency of values being upward. The congestion of orders, chiefly in war munitions, is greater than ever.

The position of pig iron is viewed with grave apprehensions by consumers because of poor prospects of increased output on the East Coast, which would require an addition to the ranks of labor from the mines to the furnaces, hardly possible now; yet special efforts are to be made with the assistance of the authorities. The regulation of the home deliveries under government

supervision is difficult, with the surplus left for the Allies very small, although shipments to neutrals are cut off. Good quantities have been lately dispatched to France against old contracts, but for the time being further permits even for France are hard to get. The f.o.b. price of Cleveland No. 3 is purely nominal, near 92s., the warrant stocks still decreasing. The situation in hematite is much the same as in Cleveland iron, the f.o.b. quotation remaining at about 140s. The growing scarcity of supplies here largely explains the negotiations that have been going on for large quantities of American iron for the Allies, especially France.

According to the Middlesbrough Chamber of Commerce returns, the output in the Cleveland district for the first quarter of this year was: Cleveland foundry iron, 322,000 tons; hematite, 230,000 tons—a total of 552,000 tons, against 533,000 tons for the previous quarter and 551,000 tons for the same period last year.

Orders for semi-finished steel are difficult to place, domestic makers having practically nothing to sell, while American material is hindered by the stiff terms asked and the dearth of vessels. Finished material is very tight. War needs absorb the great bulk, and production is maintained at the highest level. Merchant business is severely curtailed by price regulations, export restrictions, and the paucity of producers' offers. Best marked iron bars now stand at £15, delivered Birmingham.

The Benzol and Toluol Market

But little pure benzol is reported available on contract at 70c. per gal. at point of shipment. Supplies are well covered by contract, the new product coming on the market not being large. Spot benzol is held at 70c. to 80c. per gal., producer's plant, depending on the quantity, but the amount offered in the market is small. Resale lots seem to be nearly all disposed of, tending to make the market strong.

Toluol is quoted at $4.50 per gal., producer's plant, on contract and $4.75 per gal. for spot. There are limited supplies available with not much buying or selling. Consumers are well covered by contract, with production and demand about equal. Solvent naphtha is sold at 45c. per gal. for spot and 40c. per gal. on contract at producer's plant.

Australian Iron and Steel Imports

Australia's imports of various iron and steel products, according to the British trade commissioner for Australia, for the fiscal year ended June 30, 1915, were as follows:

	From the United Kingdom	From the United States	Total Imports
Pig iron and steel ingots	£162,176	£25,830	£258,167
Iron and steel bars, rods and blooms	728,672	115,837	933,594
Manufactured steel	6,789,134	1,717,099	9,441,123
Machinery	1,988,409	1,446,744	3,806,100

The machinery imports, it will be noted, make the best showing for the United States.

The Crane Company, Chicago, has presented to the college of engineering, University of Wisconsin, Madison, an exhibit of mechanical fittings and valves, valued at $1,500. It will be used for demonstration to students in steam and gas, electrical, chemical and mechanical engineering. The exhibit weighs 2400 lb. and consists of 85 pieces, nearly all quarter-sectioned to show the interior. But one other exhibit of this kind is said to be in possession of any engineering college in this country, that being in Purdue University, which also shared in the Crane Company's distribution.

Arthur D. Little, Inc., chemist, engineer and manager, announces that a Dominion charter has been granted to Arthur D. Little, Ltd., a corporation organized and equipped for the service of Canadian industry and the study and development of Canadian resources. The special facilities of the new corporation will be supplemented by the entire staff organization and equipment of Arthur D. Little, Inc. The offices will be located at 137 McGill Street, Montreal.

Iron and Industrial Stocks

NEW YORK, May 31, 1916.

An irregular market has prevailed the past week in iron, steel and industrial securities. No decided tendency has been shown, and fluctuations have not been wide except on Bethlehem Steel and Canadian Car & Foundry. The range of prices on active iron and industrial stocks from Wednesday of last week to Monday of this week has been as follows:

Allis-Chal., com.	26⅞ - 28	Ry. Steel Spring, pref.	98
Allis-Chal., pref.	81½ - 82¼	Republic, com.	47½ - 49
Am. Can, com.	56¼ - 58¼	Republic, pref.	111½ - 111¾
Am. Can, pref.	110¼ - 111½	Sloss, com.	53¼ - 54
Am. Car & Fdy., com.	59¾ - 62⅝	Sloss, pref.	95
Am. Car & Fdy., pref.	117	Pipe, com.	21 - 23½
Am. Loco., com.	71½ - 75⅝	U. S. Steel, com.	84⅝ - 86½
Am. Loco., pref.	101½ - 102¼	U. S. Steel, pref.	116¾ - 117¼
Am. Stl. Fdries.	51⅞ - 52¾	Va. I. C. & Coke	50¾ - 56
Bald. Loco., com.	87¼ - 92¾	Westing. Elec.	61½ - 63¼
Bald. Loco., pref.	109¾ - 110	Am. Rad., pref.	136
Beth. Steel, com.	442 - 459½	Am. Ship, com.	44 - 45
Case (J. I.), pref.	88	Am. Ship, pref.	88¾
Colorado Fuel	42½ - 44⅝	Chic. Pneu. Tool	71¾ - 73¾
Deere & Co., pref.	90	Cambria Steel	90
General Elec.	170¾ - 173¼	Lake Sup. Corp.	9⅝ - 10
Gt. No. Ore Cert.	40½ - 42¼	Pa. Steel, pref.	98 - 98½
Int. Harv. of N. J., com.	112	Warwick	10⅝ - 11
Int. Harv. Corp., com.	80½	Cruc. Steel, com.	82¾ - 87¼
Int. Harv. Corp., pref.	104⅞ - 105	Cruc. Steel, pref.	116¼ - 117¼
Lackawanna Stl.	70 - 72⅞	Harb.-Walk. Refrac., com.	93½
Nat. En. & Stm., com.	23¼ - 24	Harb.-Walk. Refrac., pref.	103
N. Y. Air Brake	135 - 139¼	La Belle Iron, com.	52 - 52¼
Pitts. Steel, pref.	97½ - 98¾	Can. Car & Fdy., com.	60 - 68
Pressed Stl., com	46 - 47	Can. Car & Fdy., pref.	80 - 85
Pressed Stl., pref.	100 - 100½	Driggs-Seabury	130 - 134
Ry. Steel Spring, com.	40½ - 42¾	Midvale Steel	61¾ - 64⅝

Dividends

The Scovill Mfg. Company, extra monthly, 10 per cent, payable June 1. This is the same rate as was declared in April. In March an extra 8 per cent dividend was paid in addition to the regular quarterly of 2 per cent.

The Great Northern Iron Ore Properties, of 50c. per share, payable June 27. For the past three years there has been but one 50c. dividend each year, declared in October.

The Saxon Motor Car Corporation, initial dividend, $1.50 per share, payable July 1.

The Baldwin Locomotive Works, regular semi-annual, 3½ per cent on the preferred stock, payable July 1.

The Railway Steel Spring Company, regular quarterly, 1¾ per cent on the preferred stock, payable June 20.

The Westinghouse Air Brake Company, regular quarterly, $2 a share, payable July 21.

Change in Height of Head on Set Screws

The National-Acme Mfg. Company, Cleveland, in respect to the size of head of set screws, has adopted a standard in accordance with the following formula:

The height of head shall be equal to three-fourths of the diameter of the body. These dimensions will be used for all sizes of set screws carried as standard stock. However, until 1917 either the old or revised style of heads may be considered regular and will be furnished at standard prices. The company's present stock of set screws will be replaced by the revised style as rapidly as possible. It is believed, in view of the present reduced condition of stocks, that the change will not work a hardship.

It is the company's intention also to issue a circular urging the adoption and use of the U. S. standard thread on cap and set screws and a virtual elimination of the V-thread.

British Imports of Manganese Ore

Great Britain's imports of manganese ore in April, 1916, were 45,500 gross tons against 15,414 tons in April, 1915, and the total to May 1, 1916, was 132,598 tons, against 102,019 tons to May 1, 1915. The April receipts exceed by over 50 per cent the largest previous month's record for this year.

The Smith Gas Power Company, Lexington, Richland County, Ohio, has changed its name to the Smith Gas Engineering Company.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, effective from April 10, 1916, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30.7c.; Birmingham, Ala., 45c.; Pacific coast, 65c. on plates, structural shapes, iron and steel bars, pipe and boiler tubes, tin plates, nails, spikes and wire. The foregoing rates to the Pacific coast are by rail only.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees 3 in. and over, 2.50c. to 2.75c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs	.10
Angles, 3 in. on one or both legs less than ¼ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Handrail tees	.75
Cutting to lengths, under 3 ft. to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 2.90c. to 4c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated Feb. 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft. down to the weight of 3/16 in. take the price of 3/16 in.

Allowable overweight, whether plates are ordered to gage or weight, to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras	Cents per lb.
Gages under ¼ in. to and including 3/16 in.	.10
Gages under 3/16 in. to and including No. 8	.15
Gages under No. 8 to and including No. 9	.25
Gages under No. 9 to and including No. 10	.30
Gages under No. 10 to and including No. 12	.40
Sketches (including straight taper plates), 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths under 3 ft. to 2 ft., inclusive	.25
Cutting to lengths under 2 ft. to 1 ft., inclusive	.50
Cutting to lengths under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Wire Rods.—Bessemer, open-hearth and chain rods, $60 to $62.

Wire Products.—Prices to jobbers, effective May 1: Fence wire, Nos. 0 to 9, per 100 lb., terms 60 days or 2 per cent discount in 10 days, carload lots, annealed, $2.45; galvanized, $3.15. Galvanized barb wire and staples, $3.35; painted, $2.65. Wire nails, $2.50 to $2.60. Galvanized nails, 1 in. and longer, $2 advance over base price; shorter than 1 in., $2.50 advance over base price. Cement-coated nails, $2.50. Woven wire fencing, 61½ per cent off list for carloads, 60½ off for 1000-rod lots, 59½ off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12&12½	13	14	15	16
Annealed	$2.50	$2.55	$2.60	$2.65	$2.75	$2.85	$2.95	$3.05
Galvanized	3.20	3.25	3.30	3.35	3.45	3.55	4.00	4.10

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from April 21, 1916, on black and galvanized steel and iron pipe, all full weight.

Butt Weld

Steel: Inches	Black	Galv.	Iron: Inches	Black	Galv.
⅛, ¼ and ⅜	63	30½	⅛ and ¼	52	19
½	67	46½	⅜	53	20
¾ to 3	70	50½	½	57	33
			¾ to 1½	60	38

Lap Weld

2	65	45½	1¼	48	26
2½ to 6	68	48½	1½	54	33
7 to 12	65	44½	2	55	34
13 and 14	53½	..	2½ to 4	57	37
15	51	..	4½ to 6	57	37
			7 to 12	56	36

Reamed and Drifted

1 to 3, butt	68	48½	¾ to 1½, butt	55	32
2, lap	63	43½	1¼, lap	43	20
2½ to 6, lap	66	46½	1½, lap	49	27
			2, lap	50	28
			2½ to 4, lap	52	31

Butt Weld, extra strong, plain ends

⅛, ¼ and ⅜	59	35½	⅛, ¼ and ⅜	52	29
½	64	45½	½	57	38
¾ to 1½	68	49½	¾ to 1½	61	40
2 to 3	69	50½			

Lap Weld, extra strong, plain ends

2	63	44½	1¼	50	28
2½ to 4	66	47½	1½	55	34
4½ to 6	65	46½	2	57	37
7 to 8	61	40½	2½ to 4	59	40
9 to 12	56	35½	4½ to 6	58	39
			7 to 8	52	33
			9 to 12	47	28

Butt Weld, double extra strong, plain ends

½	55	38½	½	44	26
¾ to 1½	58	41½	¾ to 1½	47	29
2 to 2½	60	43½			

Lap Weld, double extra strong, plain ends

2	55	38½	1½	44	25
2½ to 4	57	40½	2	44	25
4½ to 6	56	39½	2½ to 4	46	30
7 to 8	51	30½	4½ to 6	45	29

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Sheets.—Makers' prices for mill shipments on sheets, of U. S. standard gage, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms 30 days net, or 2 per cent cash discount in 10 days from date of invoice:

Blue Annealed Sheets

	Cents per lb.
Nos. 3 to 8	2.95 to 3.20
Nos. 9 to 10	3.00 to 3.25
Nos. 11 and 12	3.05 to 3.30
Nos. 13 and 14	3.10 to 3.35
Nos. 15 and 16	3.20 to 3.45

Above prices are for Bessemer stock. For open-hearth stock $2 per ton advance is charged.

Box Annealed Sheets, Cold Rolled

Nos. 17 to 21	2.70 to 2.80
Nos. 22 and 24	2.75 to 2.85
Nos. 25 and 26	2.80 to 2.90
No. 27	2.85 to 2.95
No. 28	2.90 to 3.00
No. 29	2.95 to 3.05
No. 30	3.15 to 3.25

Above prices are for Bessemer stock. For open-hearth stock $2 per ton advance is charged.

Galvanized Sheets of Black Sheet Gage

Nos. 10 and 11	3.75 to 3.85
No. 12	3.85 to 3.95
Nos. 13 and 14	3.85 to 3.95
Nos. 15 and 16	3.95 to 4.05
Nos. 17 to 21	4.10 to 4.20
Nos. 22 and 24	4.20 to 4.30
Nos. 25 and 26	4.35 to 4.45
No. 27	4.60 to 4.70
No. 28	4.75 to 4.85
No. 29	4.90 to 5.00

Above prices are for Bessemer stock. For open-hearth stock $2 per ton advance is charged.

Boiler Tubes.—Discounts on less than carloads, f.o.b. Pittsburgh, freight to destination added, on lap-welded steel tubes and standard charcoal-iron tubes, effective from April 15, 1916, are as follows:

Lap Welded Steel		*Standard Charcoal Iron*	
1½ in.	35	1½ in.	27
1¾ and 2 in.	47	1¾ and 2 in.	39
2¼ in.	44	2¼ in.	36
2½ and 2¾ in.	50	2½ and 2¾ in.	42
3 and 3¼ in.	55	3 and 3¼ in.	47
3½ to 4½ in.	56	3½ to 4½ in.	48
5 and 6 in.	49	5 and 6 in.	41
7 to 13 in.	46	7 to 13 in.	38

Locomotive and steamship special charcoal grades bring higher prices.

1¾ in., over 18 ft., and not exceeding 22 ft., 10 per cent net extra.

2 in. and larger, over 22 ft., 10 per cent net extra.

Metal Markets

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York		Tin,	Lead		Spelter	
		Electro-	New	New	St.	New	St.
May	Lake	lytic	York	York	Louis	York	Louis
24	29.00	28.50	47.75	7.40	7.20	14.75	14.50
25	28.75	28.50	47.50	7.35	7.20	14.62½	14.37½
26	28.25	28.00	47.25	7.35	7.20	14.25	14.00
27	28.25	28.00	....	7.35	7.20	14.25	14.00
29	28.25	28.00	46.75	7.35	7.20	14.00	13.75
30	....	....	....	...	...	....	....

NEW YORK, May 31, 1916.

Copper is lower but in the absence of business quotations are nominal. Tin has declined sharply both in London and New York and no desire to buy is apparent. The easier trend of lead has continued. Spelter is even quieter than it was and is lower. Antimony has declined further and interest is lacking.

New York

Copper.—The market has continued quiet and repeated offerings of electrolytic at 28c., 30 days delivered, for third quarter shipment have found no takers, and it is reported that when bids below this level were solicited no more interest was aroused. The fact is that consumers are well covered, so far as the contracts they have in hand are concerned, and they are not receiving sufficient new business to cause them to enter the market. Were it not for the heavily sold up conditions of the trade, prices probably would come down with a rush, but it is well understood that the producers will have plenty to do in making deliveries for some months to come. The offerings which have eased prices emanated from second hands. Their desire to sell has served to bring the quotations for prompt and future deliveries nearer together. Prompt electrolytic was quoted at 28.25c., May 29, while futures can be had easily at 28c., or a shade less. The London market for electrolytic to-day is down to £144, against £158 May 24. Some attribute this decline of £14 to the freer offerings of American electrolytic, while others believe it means a readjustment of prices in London connected in some way with an order of the Ministry of Munitions made in March which becomes effective to-day. Briefly, the order is that on this date all speculative contracts are to terminate and that hereafter no new ones are to be entered. After to-day there will be no London quotations on standard copper or standard tin; all prices must be for electrolytic copper and Straits tin. The exports in May, including May 29, totaled 14,662 tons. Lake is purely nominal at 28.25c., cash.

Tin.—Buyers have been so apathetic throughout the week that the only business done has been as the result of substantial concessions in price. Even under these conditions business has been light and insufficient to check the decline of the market. The situation is one that affects the leading sellers as well as the less important ones, and some of the latter who were active a few months ago are no longer heard of. The London market has declined £5 10s. this week, it is presumed because of the Government order forbidding all speculative contracts, and confining quotations to Straits tin, which becomes effective to-day. The quotation on Monday for spot tin at New York was 46.75c.

Lead.—In a dull market quotations have continued to grow easier. The lightness of the domestic demand is demonstrated by the manner in which sellers concentrated their efforts on recent foreign inquiries, some of which came from Japan and others from South America. So far as can be learned none of the business was placed in this country. The New York quotation of independent producers on Monday was 7.35c., and St. Louis 7.20c., while 7.25c., New York, was believed to be possible. The market has every indication of being top-heavy and lower prices are looked for this week. The exports this month, including May 29, totaled 1025 tons.

Spelter.—Quotations have continued to decline and there would have been no difficulty in obtaining spelter on Monday at 14c., New York, and 13.75c., St. Louis. June could have been had at about 13c., St. Louis; July at 12.50c., and third quarter at 12c. No interest is apparent either here or abroad. At London the quotation on Monday was £80, a decline of £10 from the previous quotation. Producers are nevertheless hopeful and are predicting higher prices in the near future. One effect of the decline in spelter was a reduction of 2c. per lb. for sheet zinc on May 29, making the new price 22.50c. The exports this month, including May 29, totaled 3746 tons.

Antimony.—Continued pressure to sell in a dull market has brought the quotations for Chinese and Japanese grades, likewise those of domestic antimony, down to 25c. to 26c.

Aluminum.—The quotation for No. 1 virgin aluminum, 98 to 99 per cent pure, is unchanged at 58c. to 60c.

Old Metals.—The market is unsettled. Dealers' selling prices are as follows:

	Cents per lb.
Copper, heavy and crucible	26.00 to 26.75
Copper, heavy and wire	25.00 to 26.00
Copper, light and bottoms	21.50 to 22.50
Brass, heavy	15.00 to 15.50
Brass, light	12.00 to 12.50
Heavy machine composition	18.50 to 19.00
No. 1 yellow rod brass turnings	15.00 to 16.00
No. 1 red brass or composition turnings	16.00 to 17.00
Lead, heavy	6.50
Lead, tea	6.00
Zinc	10.50 to 11.50

Chicago

MAY 29.—Activity in resale copper has had an adverse influence on prices, even though quantities were small. Tin and lead have been inactive, with prices steady. Spelter quotations continue to move downward, with an unusual spread existing between the prices of sheet zinc and spelter. We quote: Casting copper, 27c.; Lake copper, 28.50c.; tin, carloads, 47.50c., and small lots, 49.50c.; lead, 7.15c.; spelter, 13.50c.; sheet zinc, 23.50c.; Cookson's antimony, 50c.; other grades, 28c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 21c.; copper bottoms, 19c.; copper clips, 20.50c.; red brass, 18c.; yellow brass, 13.50c.; lead pipe, 6c.; zinc, 11c; pewter, No. 1, 28c.; tinfoil, 34c.; block tin pipe, 39c.

St. Louis

MAY 29.—Trade in non-ferrous metals has been quiet, the week closing as follows: Lead, 7.75c.; spelter, 16c.; tin, 52c.; Lake copper, 31c.; electrolytic copper, 30.50c.; antimony, Asiatic, 41.50c. In the Joplin ore district prices were a little better held than in the preceding week with zinc blende, basis range for 60 per cent, $70 to $100 per ton, with the average for the week's production of the district, $87. Calamine was firm at $50 to $66 for 40 per cent, with the district average $56 for the week's sales. Lead ore was quiet at $95 for 80 per cent. On miscellaneous scrap metals we quote dealers' buying prices as follows: Light brass, 10.50c.; heavy yellow brass, 13c.; heavy red brass and light copper, 16c.; heavy copper and copper wire, 20c.; pewter, 25c.; tinfoil, 35c.; lead, 5.75c.; tea lead, 4c.; zinc, 10c.

New Construction at Lorain, Ohio

Referring to a report that additional blast furnaces would be built at Lorain, Ohio, by the National Tube Company, Chairman E. H. Gary of the U. S. Steel Corporation said this week that there had been some talk of building an additional blast furnace and three or four open-hearth furnaces, but the matter had not been taken up for decision. At the beginning of the year, the building program announced by the Steel Corporation included four new open-hearth furnaces for Lorain.

The Wabash Mfg. Company, Terre Haute, Ind., manufacturer of coaster sleds, wagons, coat hangers, etc., has been reorganized and taken out of the hands of the receiver, Thomas J. Harrell, who has had charge for nearly a year. John J. Snyder, Buffalo, N. Y., is the new owner. A warehouse will be built and the capacity of the plant increased.

OBITUARY

CHESTER B. ALBREE died at his home in Pittsburgh May 27 after an illness of several months, aged fifty-four years. He was born in that city, and was educated at Williston Academy and the Polytechnic Institute at Worcester, Mass., where he was graduated in 1884. He founded the Chester B. Albree Iron Works, of which he had been the president and active head for many years. He was an inventor and manufacturer of machinery and mechanical devices, some of which are in wide use in this country. He was a past president of the Engineers' Society of Western Pennsylvania and a member of the American Society of Mechanical Engineers, Pittsburgh Club, Duquesne Club and other societies. He leaves his widow.

WILLIAM P. HARPER, chief of the purchasing department of the Allis-Chalmers Mfg. Company and president of the Northwestern Mfg. Company, Milwaukee, Wis., was found dead in bed on May 27, death being due to apoplexy. He was born in Milwaukee fifty-two years ago and became associated with the Allis-Chalmers interests in 1901 as purchasing agent. He assisted in founding the Northwestern Mfg. Company, motors and dynamos, in 1904, and had been president ever since. He leaves his widow and one son.

PERSONAL

Elbert H. Gary, president; Powell Stackhouse, first vice-president; Willis L. King, second vice-president; Charles M. Schwab, third vice-president; Edward Bailey, treasurer, and James T. McCleary, secretary, were re-elected as officers of the American Iron and Steel Institute at the meeting of the directors in New York, May 26.

R. H. Stevens, who has been chief engineer of the Midvale Steel Company and Worth Brothers Company, is now attached to the operating department of the Worth Brothers Company as assistant to H. I. Schotter, general superintendent.

James A. Nolan, for some years superintendent of the track tool department of Hubbard & Co., Pittsburgh, has resigned to accept a similar position with the Oliver Plow Company, Hamilton, Canada. He was given a farewell dinner by his associates and friends May 29, at which R. L. Mason presided.

R. C. Skiles has been elected a director of the Ohio Seamless Tube Company, Shelby, Ohio, to fill the vacancy caused by the death of his father, G. M. Skiles, president of the company. E. M. Wiggins, first vice-president, is acting as president.

Lloyd E. Shirley, for a number of years superintendent of the foundry of the C. S. Bell Company, Hillsboro, Ohio, has severed that connection and is now with the Garland Mfg. Company, Des Plaines, Ill., as vice-president and general manager.

C. C. Todd, who for many years has represented the Central Foundry Company in the West, and who about a year ago was elected as one of its vice-presidents, will open a Chicago office for the company on July 1.

Charles M. Schwab will provide for Bethlehem and South Bethlehem, Pa., a concert auditorium, to be located near Lehigh University, and to cost upward of $100,000.

F. D. Grunder has been appointed assistant general sales manager of the tube department of the Jones & Laughlin Steel Company, Pittsburgh.

At the annual meeting of the directors of Fairbanks, Morse & Co., at Chicago, May 17, the following officers were elected for the current year: Chairman of the board, C. H. Morse, Sr.; president, C. H. Morse, Jr.; first vice-president, W. E. Miller; vice-president, H. C. McClary; vice-president, H. J. Fuller; secretary and treasurer, F. M. Boughey; assistant treasurer, B. E. Cremerius; assistant secretary, C. A. Meyer.

Andrew Bryson has resigned the presidency of the Brylgon Steel Casting Company, New Castle, Del., and has severed his connection with the company.

Frederick H. Lewis, formerly in the order and shipping department of the Carnegie Steel Company, Pittsburgh, has resigned to accept a position in the same department of the Midvale Steel & Ordnance Company, Philadelphia, Pa.

Joseph F. Guffy, general manager of the Philadelphia Company of Pittsburgh, has been elected president of the Gas Association of America.

David O. Holbrook, Pittsburgh, representing in that city the Dayton Pipe Coupling Co., Dayton, Ohio, has been elected resident secretary of the Gas Association of America, with offices in the Oliver Building, Pittsburgh. He is also president of the Association of Natural Gas and Supply Men.

F. M. Beach, formerly sales manager of the Massillon Rolling Mill Company, Massillon, Ohio, has resigned, and has been succeeded by H. A. Taubensee.

Edward T. Stotesbury having resigned as president of the Keystone Watch Case Company, Philadelphia, Franklin A. Taylor was chosen to fill the vacancy.

Directors of the American Brake Shoe & Foundry Company have elected Otis H. Cutler chairman of the board and William G. Pierce president to succeed Mr. Cutler. James Thomson, William S. Gowan and Clifton D. Pettis were chosen additional vice-presidents.

Dr. William B. Phillips, president of the Colorado School of Mines, Golden, Col., announces the appointment to the professorship of metallurgy of George J. Young, now professor of mining engineering at the University of Minnesota; of Claude C. Van Nuys, now professor of physics at South Dakota School of Mines, to be professor of physics.

For Russian Trade with United States

Sterling H. Bunnell has resigned from his engineering and sales connection with the Griscom-Russell Company which has extended over the past nine years, and has become chief engineer of R. Martens & Co., Inc., the New York connection of R. Martens & Co., Ltd., of London, of which David A. Thomas (Lord Rhondda) is president, and Richard Martens, a Russian by birth and citizenship, is vice-president and general manager. The firm has its own pier on Staten Island and will operate a line of steamships to Russian points after the close of the war. In preparation for the extensive business which will be done between Russia and the United States, the Russian branches are investigating the conditions in the engineering and agricultural fields through a force of English and American engineers who will spend the next six months in Russia. The New York house will carry on the work of arranging to represent American manufacturers in Russia and of transmitting information, prices and descriptive matter through the Russian office. Catalog descriptions of various American lines are being put into Russian, and at Petrograd an extensive loose leaf catalog will be issued. The Russian branch houses are at Petrograd, Vladivostok, Moscow and Archangel and other branches will be established at Odessa, Tomsk and Baku.

With a membership of about twenty-five, a branch of the American Society of Mechanical Engineers has been organized in Baltimore, Md. The temporary chairman is Dr. C. C. Thomas, Johns-Hopkins University; secretary, Prof. A. G. Christie, Johns-Hopkins University; executive committee, A. G. Sandman, A. G. Christie, J. R. Forney, E. B. Passano and A. Kennedy.

The Van Dorn & Dutton Company, manufacturer of gears, Cleveland, Ohio, announces the removal of its Denver, Col., offices from the Ideal Building to 1633 Tremont Street. C. H. Davidson is the district sales manager.

Pittsburgh and Nearby Districts

The Youngstown Sheet & Tube Company, which is building by-product coke ovens at East Youngstown, Ohio, expects to have the entire 204 finished and in operation early in July. All the coke made will be used in its four blast furnaces and the surplus gas in the heating furnaces. The Barrett Company will take over the coal tar, ammonia and benzol, and is now building a plant near the ovens to take care of these products. The Sheet & Tube Company is now occupying its new office building at East Youngstown, the engineering and other departments having moved into it last week. This building cost $300,000 and is very complete in every detail. The executive offices of the company will remain in the Stambaugh Building, Youngstown.

The Bessemer and open-hearth departments of the Republic Iron & Steel Company at Youngstown, Ohio, are operating to utmost capacity and making some new records for output.

Herbert E. Herrod has been appointed executive secretary of the Mahoning Valley Employers' Association, and has opened offices in room 1816 Stambaugh Building, Youngstown. He formerly held a similar position with the Manufacturers' Association of Hamilton, Ohio. An organization was temporarily effected in Youngstown the latter part of April, under the name of the Employers' Association of Youngstown, and the Mahoning Valley Employers' Association will take up its program of work, which contemplates the promotion of co-operation among its members for the benefit of themselves, employees and the general public.

C. S. Robinson, vice-president Youngstown Sheet & Tube Company, Youngstown, Ohio, and a member of the Ohio board for industrial preparedness and associate member of the Naval Consulting Board of the United States, says that an inventory of Ohio establishments, to determine what part they could take in the scheme of national preparedness, will be started within a short time.

The Carnegie Steel Company has recently placed orders for four 15-ton and two 20-ton cranes to be installed in its Duquesne works at Duquesne, Pa., and a 40-ton crane for its Homestead works. It is about to place contracts for 26 cranes, with a lifting capacity ranging from 10 to 40 tons, for its new bar, hoop and band mills to be erected at McDonald, Ohio, and is negotiating for two special cranes for the Edgar Thomson works. The Union Railroad, a Carnegie Steel Company interest, is in the market for a 66-in. open-gap punch of the overhead type to punch 1-in. holes through 1-in. plates.

The Huessener Engineering Company, Inc., Pittsburgh, has received orders to equip boilers with Bradshaw burners at the following blast-furnace plants: Lackawanna Iron & Steel Company, North Cornwall, Pa.; Lackawanna Iron & Steel Company, Lebanon, Pa.; Lackawanna Steel Company, Buffalo, N. Y.; Marting Iron & Steel Company, Ironton, Ohio, and Joseph E. Thropp, Saxton, Pa. The Lackawanna Steel Company has also acquired a license to erect three Steinbart gas washers at two of its furnaces at Buffalo.

At Washington, D. C., on May 25, the Interstate Commerce Commission handed down a decision in the case of the Pittsburgh Steel Company against the Pittsburgh & Lake Erie Railroad Company, in which the former was awarded an allowance of $2.25 per car on iron ore shipped into its plant from the railroad. The record shows that during the period when the railroad suspended paying allowance, from July 20, 1913, to April 1, 1914, 6350 cars of ore were delivered to the Monessen plant of the complainant. The commission says: "We conclude and find that the failure of the defendant to pay the allowance of $2.25 a car, either to the Pittsburgh Steel Company or its industrial railroad, when such allowances were paid to the complainant's competitors through their industrial railroads, subjected the Pittsburgh Steel Company and its industrial railroad to unlawful prejudice and disadvantage."

Reports have been current of a proposed merger of several of the large builders of rolls and rolling-mill machinery located in the Pittsburgh district, and these reports recently designated the A. Garrison Foundry Company, Mesta Machine Company, Seaman-Sleeth Company and others. These three companies officially deny that they are involved in any such scheme. So far as known, nothing definite has been done looking to a consolidation of any other concerns in the Pittsburgh district in these trades, all negotiations thus far having been without result.

The blast furnace of the Struthers Furnace Company, at Struthers, Ohio, which was shut down about a month ago for relining and extensive repairs, is expected to be ready for operation again early in July.

The National Association of Corporation Schools is holding its fourth annual convention in Pittsburgh this week. The membership includes a large number of corporations engaged in the manufacture of iron and steel.

The H. Koppers Company in the Northwest

In October, 1915, the Western States Coke Company contracted with the H. Koppers Company, Pittsburgh, for a by-product coke plant to be erected in the vicinity of St. Paul, Minn. Differences arose with the St. Paul Gas Company in regard to the location of the coke plant, the Coke Company having decided to build it in Minneapolis, and this resulted in a suit brought against the Coke Company by the Gas Company for breach of contract. This matter has now been amicably settled, and the Western States Coke Company has assigned the contract to the H. Koppers Company, who will build the coke plant on a site near the machine shops of the Northern Pacific Railroad in St. Paul. The plant, when completed, will be operated by a new corporation to be known as the Minneapolis By-Product Coke Company. Work will be started at once, and it is expected to have the ovens in operation early in the summer of 1917. The plant will consist of 55 12¼-ton combination by-product ovens and will be erected with high grade modern equipment throughout.

On May 8 the first complete by-product coke plant erected by the new organization of the H. Koppers Company was put in operation for the Toledo Furnace Company, Toledo, Ohio. Work on construction of this plant was started in June, 1915, and its completion in about 11 months makes a record in quick construction. The plant consists of 94 12¼-ton ovens, in two batteries, with gas separation and a complete benzol plant. The new ovens are essentially different from previous plants erected by the H. Koppers Company, in that the width of the ovens is materially changed. The plant has been in operation for over two weeks and there is reason to believe that the efficiency in coke quality and high by-products yield will be exceptional.

Sizer Forge Company Building a New Plant

The Sizer Forge Company, Buffalo, N. Y., is building a new forge plant which will be 256 x 540 ft. It will comprise a machine shop, covered yard, forge shop with powdered coal equipment for furnaces and boilers and an open-hearth furnace for making large billets and ingots. The forge shop will contain in addition to the usual forging hammers and blacksmith equipment, an electric furnace, a 1200-ton press and proper annealing facilities. The plant will be capable of handling forgings of sufficient size to include stern frames and rudder frames for large vessels.

Plans for the electric steel foundry for the Electric Steel Castings Company, Milwaukee, Wis., as drawn by Vaughn, Meyer & Sweet, Milwaukee, the consulting engineers, call for a one-story foundry, 80 x 500 ft.; a two-story shop, 40 x 150 ft., and a one-story boiler house, 40 x 90 ft., which are somewhat larger dimensions than were given in THE IRON AGE of May 18.

The Racine Steel Castings Company, Racine, Wis., which recently placed in operation its three-ton Heroult electric furnace, is making a specialty of casting rolling ingots of special analysis, furnishing ingots up to three tons in weight.

STRIKES AND WAGE ADVANCES

Cincinnati Strike About Ended

Although the Cincinnati machinists' strike has not been officially declared off, it is practically a thing of the past. Strikers are still returning to work and new men are being added to fill up gaps in the different shops where needed. The following is a carefully revised statement of the situation:

Total number of men at work April 29, 1916	13,490
Total number of men at work May 26, 1916	13,261
Number of strikers who returned to work May 23, 24, 25	21
Number of new men added in the three days mentioned	111

At Hamilton, Ohio, the pattern makers in two shops are still out, but a number of new men have been added to working forces. The strike at the Mosler Safe Company's plant at Hamilton has been declared off, and practically all the men have returned to work. A misunderstanding between the men and the employers was stated to be a misunderstanding on the overtime agreement. The company agreed to pay time and one-half for overtime, but also stated that no overtime work would be given. This was misunderstood by the men, who stayed out several days on a strike, but the matter was finally adjusted.

Eastern Developments

New England situation shows signs of improvement. The plant of the Ansonia Mfg. Company, Ansonia, Conn., was opened May 25, when a considerable number of the employees resumed their places. It is believed that more of the strikers will quickly decide to take up their old jobs. At the factory of the Hendey Mfg. Company, Torrington, Conn., the strikers continue to show a disposition to stay out, but the company has now more than one-half its usual working force, and it would appear that the strike is a failure. All the small strikes are in peaceful condition, and there are fewer visible signs of labor disturbances than for many months.

The Ellwood Ivins' Tube Works, Oak Lane, Philadelphia, manufacturer of seamless steel tubes, has reduced the working hours of all employees one hour each day. This applies to both day and night shifts. The plant is running full 24 hr. each day. A voluntary increase in wages of all employees was made a few months ago.

Announcement has been made by the Reading Coal & Iron Company that the 800 employees in its repair shops at Pottsville, Pa., will hereafter work only 9 hr. for a day's wages, instead of 10 hr. An additional concession of 2 hr. is made on Saturday. The company also announced that a raise in wages has been granted to all machinists, effective immediately.

The Primos Chemical Company, of Primos, Pa., has voluntarily granted its laborers an increase in wages, making the present schedule 20c. an hour. The men work 9½ hr. daily, and are paid for an extra hour. The plant is working day and night.

At Newark, N. J., employers numbering close to 300 have been notified by the International Association of Machinists that the machinists and tool and die makers would, on June 15, insist on their demand for an 8-hr. day and an increase in wages of approximately 5c. an hour. A meeting of the local union will be held June 8 to consider the answers and vote on what action to take. At a recent meeting the union men voted for an 8-hr. day and a minimum wage of 50c. an hour for machinists and 60c. an hour for tool and die makers. A few employers in Newark, Harrison, and nearby towns have already granted the terms sought, but in all the larger cities of the State outside of Newark most machine shops are on the 9-hr. basis, with some running 50 hr. per week.

Pittsburgh and Northern Ohio Situation

Skilled labor in the employ of the American Rolling Mill Company at Zanesville, Ohio, has been given a voluntary increase in wages ranging from 5 to 10 per cent. It is the third increase in wages made by the company this year.

The Buckeye Engine Company, Salem, Ohio, has reached an agreement with its employees under the terms of which the men will have a 9-hr. day from July 1, Saturday afternoons off, and time and a half for overtime. Their wages are to be advanced 10 per cent Dec. 1, and they are to have an 8-hr. day, with no reduction in pay, starting July 1, 1917.

Milwaukee Efforts to Harmonize

The Industrial Commission of Wisconsin, on Friday, May 26, began an investigation of the hours of labor in the metal-working industries of Milwaukee, as requested by 35 large employers, upon being apprised of the proposed demand of organized machinists for an 8-hr. day at the same daily wages now paid. The commission is sitting in Milwaukee, and in the executive sessions there are always present three representatives of the petitioning employers and three representatives of the machinists' organization. It is stated that the purpose of the investigation is merely to obtain facts, and it is by no means the purpose to decide any question or dispute which may arise. The duration of the investigation is, of course, in doubt, but the organized machinists have urged the commission to complete it speedily, so that the matter of adjusting the hours of labor may not be delayed until winter. In fact, it is said the union has warned the commissioners that only on condition of speedy action will they consent to delay their own demand, regardless of the acceptance of the proposition of the employers that a thorough investigation be made upon which to base future relations.

Locomotive Buying Still Active

Orders for over 150 locomotives and inquiries for 700, including 600 small ones for Russia, have appeared in the past two weeks. The Chesapeake & Ohio is reported to have ordered 25 locomotives from the American Locomotive Company and 25 from the Baldwin Locomotive Works, while the Canadian Government Railways have ordered 30 from the Canadian Locomotive Company. The American Locomotive Company will build 10 Santa Fé locomotives for the Denver & Rio Grande; the Lima Locomotive Corporation 14 for the Southern Railroad which may buy 20 more, and the Baldwin Locomotive Works 20 locomotives for the Paris & Lyons Railroad of France. The New York Central is reported to be inquiring for 25 Mallets and the Pennsylvania Lines West for 75 Mikados. Russia has bought 70 American Locomotive narrow gage engines.

Australian Firm Opens American Office

Harrisons Ramsay Pty., Ltd., the main office of which is at Melbourne, Australia, has established a branch at 90 Wall Street, New York, in charge of William L. Nederhoed as United States manager. The branch will act as agent and manufacturers' representative exporting to Australia and New Zealand, specializing in machinery and hardware. The firm, which is a consolidation of the Fraser, Ramsay Pty., Ltd., Melbourne, and Harrisons & Crossfield, Ltd., London, maintains eight offices in Australia and New Zealand, each in charge of a managing director. These offices are located in Melbourne, Sydney, Brisbane and Adelaide, Australia, and Auckland, Wellington, Christchurch and Dunedin, New Zealand.

The Seattle Car & Foundry Company, Seattle, Wash., has accepted an order from the Russian Government to supply 1000 steel cars for use in transporting supplies and troops, according to O. D. Colvin, vice-president and general manager, who has recently returned from Europe. The cars will cost $1,500,000, and work will proceed with construction as soon as the order has been confirmed by the Purchasing Commission of the Allies at London. The cars will have steel bodies and Westinghouse air brakes. The company has sold a large number of these cars to Japan in the last four years.

Machinery Markets and News of the Works

FOREIGN TRADE HAMPERED

War Restraints Hurt Machinery Exports

Russian Buying Prominent—Domestic Business Steady—The Railroads Only Purchasing in a Small Way—Deliveries Easier

The restrictions placed on exports of machine tools to neutral countries in Europe by the warring nations is the cause of bitter complaint by exporters. It is stated that in some cases communications have been delayed for months. The protest of the United States lodged with Great Britain and France by the United States Government, it is hoped, will bring some relief.

That the munition business has its ups and down has been emphasized of late by the canceling of a contract between the Serbian Government and a New England manufacturer, with the necessary disposal of all the special equipment that had been laboriously got together. The failure of other manufacturers of small arms to make deliveries is also causing legal difficulties.

Despite all drawbacks foreign business keeps up. Russian interests continue to buy actively for export via Archangel. In Cleveland such business is increasing, and several new inquiries have appeared for turret lathes and screw machines in lots up to 50, for early delivery. Only a few builders can quote on such specifications. Most of the foreign business to be had in Cincinnati is from this same source.

Business in prospect from the railroads is slow in closing. Long lists of equipment are few and far between; but a close scrutiny shows that the aggregate of their purchases of single tools in recent weeks amounts to a surprisingly large total. The Santa Fé has issued a list of 15 tools. A number of the larger railroad systems are taking surveys of their shops to ascertain what equipment is needed. This is a precautionary measure, which indicates that the known shortage of this equipment might become a serious handicap.

The machine tool demand is steady and is mostly from domestic manufacturers, especially in the East and Central West. Some of the shell manufacturers who have been operating on a large scale have become much less active in this direction, finding that the demand for their regular products is sufficient to keep them busy.

Deliveries of many types of machine tools can now be had in from one to two months. On the other hand some makes of grinding, hand screw and milling machines are a month or two behind in deliveries. Labor troubles and strikes are the cause of most of this. It is a notable fact, however, that delayed deliveries have not caused cancellations of contracts.

The Youngstown Sheet & Tube Company, Youngstown, Ohio, is reported to be spending $100,000 for new equipment.

Manufacturers of brass goods are all making additions to their manufacturing facilities. The American Brass Company is building a new brass foundry and a rolling mill at its branch in Kenosha, Wis. The outlay, by which it is planned to double the capacity of this plant, is estimated at $2,000,000. The company is also making extensions and improvements at its plant at Waterbury, Conn., estimated to cost $400,000.

Milwaukee interests have purchased for about $1,000,000 the control of the Baltimore Dry Dock & Shipbuilding Company, Baltimore, Md.

The Wayne Oil Tank & Pump Company, Fort Wayne, Ind., is about to build an addition to its works 400 ft. long.

In the Pacific Northwest metal-working plants are now operating at near capacity, principally on lumber-mill equipment, mining and dredging machinery and marine work. Japanese firms are placing large orders for American paper mill machinery. The amount of machine-tool business on the Pacific coast, although mostly for single tools, is large and includes a number of substantial orders.

New York

NEW YORK, May 30, 1916.

While deliveries of many types of machine tools can be had in July, some even in June, others, including some makes of grinding, hand screw and milling machines are from one to two months behind in their deliveries, a situation which can be attributed to the recent strikes, and which is seriously affecting the business of dealers. It is a notable fact, however, that delayed deliveries have so far not been responsible for cancellations.

Large sellers describe the demand as steady, most of it coming from domestic manufacturers who are extending their facilities, and it is not in any sense "war business." Some firms which have been manufacturing shells on a large scale are gradually becoming less active in this direction, and are finding that the demand for their regular products is ample to keep them busy.

While the general impression is that the railroads have not been active as buyers, and this is true so far as imposing lists are concerned, inquiry discloses that their purchases of single tools in recent weeks total a good aggregate.

Russian interests continue fairly active in buying tools for export via Archangel, one order specifying 12 large turret lathes. They also have inquired for engine lathes.

Inquiry is out for a large amount of shell-making machinery which perhaps is the only large one for this class of equipment, but details are unavailable at this time.

Exporters to neutral European countries express themselves bitterly over the restrictions placed on their business; especially so over interferences and delays to which their mail is subjected. They are hoping for some degree of relief from the protest which the United States has lodged with Great Britain and France against interference with neutral mails. In some cases communications have been delayed for months.

The Rochester Trailer Company, manufacturer of trailer cars for automobiles, East Rochester, N. Y., has increased its capital stock from $25,000 to $30,000 to provide for an expansion in its business. It is expected that much greater expansion will be necessary before the end of the present season. C. A. Midworth is treasurer.

The Myrick Machine Company, Olean, N. Y., is erecting an addition to its machine shop, 25 x 90 ft.

The Columbia Mantel Company, 274 Leonard Street, Brooklyn, N. Y., has purchased a plot, 131 x 240 ft., at Remsen Street and Burr Avenue, Jamaica, Long Island, N. Y., but does not intend to build at present, as has been stated elsewhere.

The Yankee Steel Company of America, recently incorporated in Delaware with a capital stock of $1,000,000, $600,000 preferred, has established headquarters at 82 West Broadway, New York. It has acquired a plant at New Cumberland, W. Va., comprising a brick manufacturing building of 60,000 sq. ft. of floor space and 10 acres of land, where it will manufacture large metallic cans and kegs and similar products. Ephraim Truxall is president; Daniel Taylor is vice-

president and sales manager and Isaac E. Laughlin is secretary and treasurer. These officers, with Artemus Smith and Arthur W. Spencer, are the board of directors. Its Pittsburgh offices are in the Union Bank Building. W. A. Hirtle, Diamond Bank Building, Pittsburgh, is consulting engineer. It is considering the establishment of puddling furnaces and mills for producing its own requirements in bars, sheets, etc.

The Empire Art Metal Company, College Point, N. Y., has purchased the Karsch brewery plant comprising two, four and five-story buildings, with two acres of land, for storage purposes. It has found it necessary to have storage capacity for several hundred dollars' worth of finished material ready for installation at the time designated in order to avoid delays in construction. John W. Rapp is president and treasurer.

The Crystal Ice & Storage Company, Buffalo, is building an ice-making plant at Delaware Avenue and the New York Central Railroad, to cost $20,000.

The Seneca River Iron Works, Baldwinsville, N. Y., has been incorporated by A. E. Hall, M. E. and L. Locks, to manufacture structural steel, architectural iron, etc.

The Hamil Chemical Company, Utica, N. Y., has been incorporated with a capital stock of $200,000 to manufacture chemicals, scientific apparatus, and specialties. E. C. Richards, A. M. Thomsen, 1012 Miller Street, and A. S. Hughes, 1509 Oneida Street, Utica, are the incorporators.

The W. P. Sharp Mfg. Company, Binghamton, N. Y., has filed incorporation papers and will manufacture dental and surgical instruments, dental supplies, metals, chemicals, etc. Its capital stock is $50,000. The incorporators are W. M. Sharp, C. T. Kinsman and H. M. Smith.

The Nitrated Chemical Company, Kingston, N. Y., has let contract for the erection of a laboratory, eight outbuildings, a storehouse and office building. B. Metzger is president.

New England

BOSTON, MASS., May 29, 1916.

The freight embargo situation has changed very much for the better. It has been lifted in large part the last few days and in consequence a big movement of less than carload lots is in progress. A new demurrage tariff went into effect May 25 on the New Haven lines which raises the charge to $7 per car when held over five days. It is believed this new charge which can, if necessary, be continued until July 24, will result in very much prompter unloading of freight. The embargo against East River piers at New York is still in force but it is believed to be only temporary.

The Hopkins & Allen Arms Company, which has a plant in Norwich, Conn., is defendant in a suit for failure to provide rifles to the British Government under a contract which called for the completion of 400,000 rifles previous to Dec. 31, 1915. The suit is being brought by Robert Michaelis of London, England, for his commission as agent, which is said to be about $2.50 per rifle.

The daily press has made considerable comment in the past week on what is deemed an industrial miracle in the Marlin Fire Arms Corporation turning out a complete Colt automatic machine gun in four months' time. It is reported that by the end of the month 2000 will be employed, working in two shifts, and that by October the production of the factory will be 200 completed guns per day. If successful in reaching this speed the entire order of 12,000 machine guns will be shipped by the end of the year, according to the contract. The guns are intended for use in Russia.

The Providence Engineering Works, Providence, R. I., long identified with the manufacture of steam engines and pumps, is to go out of business and the plant is offered for sale. Officials of the company say that it is giving up the business because Richard A. Robertson, the president, wishes to be relieved of the management, and his associates have other interests which demand their exclusive attention. The company has been in existence since 1827 and has recently had 1000 men on its payroll. It has of late been largely engaged in the manufacture of shells for the British Government, having had several contracts.

What is known as the West End section of Waterbury, Conn., is showing signs of great industrial growth. At the present time the new plant of the Eastern Brass & Ingot Company is one of an impressive group of factories which is under construction in this district. Close by this plant ground has been broken for the new building of the A. H. Wells Company, tube manufacturer. Another plant nearby is staked out but no information can be secured as to the building which is projected for construction thereon. The largest of the new buildings in this district is that of the Waterbury Tool Company, which covers almost two acres. The construction is of concrete and brick. The floors of the plant are laid and before long it will be in operation. The company has built a number of cottages which will be for the occupancy of its workmen. This is the first effort of this kind by any large firm in Waterbury.

The city of Hartford is in the midst of a prosperity boom unequaled in its history and, with one or two exceptions, unequaled in the history of New England. There are several new plants under construction or now being equipped, including the large plant of the S. K. F. Ball Bearing Company. About $75,000,000 has been distributed in the past year and an increase in the city's population of about 15,000 has taken place. It is understood that two firms alone have contracts on hand which will total about $50,000,000.

The Metal Specialty Mfg. Company, Waterbury, Conn., is having plans drawn for a brick and steel factory, 98 x 170 ft., one story, to be erected in the section known as Brown's Farms.

The Scovill Mfg. Company, Waterbury, Conn., has awarded a contract for a reinforced concrete chemical laboratory, 50 x 113 ft., one story. A contract has also been awarded for an addition, 35 x 40 ft., for an oil house on Hamilton Street.

The American Brass Company, Waterbury, Conn., is having plans drawn for a brick and steel building, 75 x 150 ft., three stories, to be erected on Crane Street. It has taken out a permit for a one-story brick building to be erected on Washington Avenue.

The Chase Metal Works, Waterbury, Conn., has begun the foundation work for a concrete factory, 62 x 182 ft., five stories, on Thomaston Avenue. It will also build an addition to an existing factory, 60 x 100 ft., two stories, and an addition to the blacksmith shop, 60 x 100 ft., one story.

C. F. Dahlborg & Sons, Brockton, Mass., have been incorporated with a capital stock of $25,000, to deal in iron, steel and heavy hardware. The directors are Charles F. Dahlborg, president; Carl E. Dahlborg, treasurer, and G. F. Dahlborg.

Shortell Brothers, Ansonia, Conn., will be the lessees of a foundry building, 60 x 100 ft., for which the Ansonia Chamber of Commerce, Industrial Building Company is asking bids. The old plant of Shortell Brothers was destroyed by fire a few weeks ago.

The Massachusetts Machinery Company, Boston, has been incorporated with a capital stock of $50,000 to build wrapping machines. The directors are John P. King, president; Harold K. Merrow, treasurer, and J. W. Greer.

The Remington Arms-Union Metallic Cartridge Company, Bridgeport, Conn., has awarded a contract for the erection of a casting shop, 50 x 220 ft., with an ell 40 x 113 ft., one story.

The Associated Tanners' Machinery Company, Salem, Mass., has been incorporated with a capital stock of $50,000. The directors are John W. O'Donnell, president; Frederick R. Barker, 100 High Street, Boston, treasurer, and George M. Foster.

The Audiphone Company, Boston, Mass., has been incorporated with a capital stock of $10,000 to manufacture aids to hearing, etc. The directors are Ezechiel Weintraub, president; William H. Walker, treasurer, and D. H. Walker.

It is reported that the Electric Cable Company, Bridgeport, Conn., which was lately combined with the Habirshaw Cable Company, Yonkers, N. Y., contemplates the erection of an addition to the Bridgeport plant.

Good progress is being made on the new steel and concrete building for the Birmingham Iron Foundry, Derby, Conn., which is 65 x 215 ft., with wings 35 x 140 and 40 x 140 ft., respectively.

The Morgan Construction Company, Worcester, Mass., has taken out a permit for the erection of a three-story brick, steel and reinforced concrete factory and office building on Belmont Street, near Lincoln Square, at a cost of $70,000.

The Norton Company, Worcester, Mass., has secured a permit for a one-story brick, steel and concrete powerhouse on Gleason Avenue, at a cost of $45,000.

Baltimore

BALTIMORE, MD., May 29, 1916.

A syndicate controlled by the Wisconsin Securities Company, Milwaukee, has purchased a majority interest in the Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., at a price of approximately $1,000,000. The Milwaukee company heretofore confined its purchases to stock and bond issues of public utility companies, and this is its first venture in the shipbuilding industry. The Baltimore company is employing 1982 men and has contracts in hand valued at more than $3,000,000. Thomas H. Bowles, formerly of Milwaukee, and president of the company, will retire from the

office direction, although he is a member of the syndicate. H. A. Evans, vice-president and general manager, will succeed Mr. Bowles. George P. Miller, attorney, Milwaukee, represented the Wisconsin Securities Company in the purchase, which was closed May 25.

Work is progressing rapidly on the plant of the Baltimore Car & Foundry Company, Curtis Bay, Md., a branch of the Standard Steel Car Company. Work is to start on a machine shop, 60 x 320 ft., in the near future.

A coal-hoist will be installed at Crisfield, Md., by the New York, Philadelphia & Norfolk Railroad Company, Cape Charles, Va.

The Tilley-Reimann Iron Works, Inc., manufacturer of ornamental, architectural and structural iron, boilers, tanks, etc., which has removed from Bristol, Va., to Sistersville, W. Va., is having plans prepared for the buildings for its new plant at Hanford City. The main structure will be 50 x 125 ft., one story, of brick construction, with office building, 25 x 30 ft. Its working force will be increased from 22 to about 60 men when the new plant is completed. The company has been re-incorporated in West Virginia for $50,000. John G. Tilley, president and treasurer, will have charge of the boiler, tank, stack and sheet-iron branch of the business; and F. A. Reimann, secretary and general manager, will handle the other lines produced.

Cleveland

CLEVELAND, OHIO, May 29, 1916.

The foreign demand has improved. Several new inquiries, mostly for Russia, have come out for turret lathes and screw machines in lots up to 50. As these are wanted for early delivery, only a few large builders are able to figure on this business. Locally, a fair volume of business is being placed in single machines and small lots. One inquiry is pending for 12 to 15 tool-room lathes. Grinding machines are in good demand and very hard to secure for early delivery. Shaping machines and large planing machines are also scarce. Steam hammers are in good call, and among new orders is one for an 8000-lb. hammer placed by a Toledo forge shop. The Wheeling & Lake Erie Railroad Company is in the market for a 400-lb. wheel press. Railroad inquiry generally is light.

The Park Drop Forge Company, Cleveland, will enlarge its plant by an addition to its machine shop, 40 x 100 ft., and has further extensions in view. The past few weeks it has increased its heat-treating department by the addition of three large double-end furnaces and the erection of a pickling house, 24 x 48 ft. Its steel storage space has been enlarged by building a second railroad siding 500 ft. in length.

The National Screw & Tack Company, Cleveland, will enlarge its plant by a five-story extension, 50 x 80 ft. Some new equipment will be required.

The G. H. Scott Machine Company, Cleveland, has taken over an entire floor of the factory building in which it is located at 118 Noble Court and has added a large amount of additional machinery. It makes a specialty of tool and gage work.

The Northern Blower Company, Cleveland, has received bids for the construction of a plant at the foot of West Sixty-fifth Street.

The Cleveland Milling Machine Company, Cleveland, recently organized, has established a temporary plant in the Whitney Power Building, where it is manufacturing milling cutters. It is rushing work on a plant which it expects to occupy in about thirty days.

The Standard Lathe & Tool Company, Cleveland, has been incorporated with a capital stock of $25,000 by C. J. Robison and others. It is at present making lathes, but will shortly place a grinding machine on the market.

The Punctureless Auto Tire Company, Akron, Ohio, has acquired a site in Barberton on which it will erect a plant, 60 x 400 ft., and a powerhouse.

The Double Tire Service & Rubber Company, Akron, will move to Barberton, where it will establish a plant in the building formerly occupied by the Lily Rubber Company. Another factory will be erected.

The Houghton Elevator & Machine Company, Toledo, Ohio, will increase its capital stock from $25,000 to $400,000, and is planning the erection of a large new plant, having taken an option on a site of four acres.

R. J. Keich, architect, Western Reserve Bank Building, Warren, Ohio, has received bids for a three-story and basement factory, 64 x 140 ft., to be occupied by the Packard Electric Company.

The Varley Mfg. Company, Findlay, Ohio, has been incorporated with a capital stock of $20,000 to manufacture hardware specialties and automobile parts. E. H. Crawford, Fred Oswald and others are the incorporators.

The Independent Tack Company, Fostoria, Ohio, has ordered additional machinery and will double the capacity of its plant.

The Marion Tire & Rubber Company, Marion, Ohio, has purchased the plant of the Ackerman & Lowe Piano Company in that city and will enlarge and equip it to manufacture rubber products.

Chicago

CHICAGO, ILL., May 27, 1916.

Railroad inquiry has been further augmented by a list of some 15 tools issued by the Santa Fe. The business in prospect from the railroads is slow in closing, some of the tools required being purchased, the buying of others being delayed apparently because of prices and deliveries. The amount of machine tool buying that has been done by steel mills for their machine shops has had less prominence than other extensions to works, but has been in like proportion. The Youngstown Sheet & Tube Company is now spending $100,000 for new equipment.

The Goetz Company, manufacturer of brewery machinery, 1802 Clybourn Avenue, Chicago, will dispose of the entire equipment of its boiler shop at auction June 1.

The W. D. Allen Mfg. Company, maker of mill and factory supplies, Chicago, has arranged for the erection of a seven-story-mill building, which will be used for offices and warerooms.

The Lindsay Light Company, 160 Grand Avenue, Chicago, is building a one-story addition to its factory, 51 x 71 ft., to cost $6,600.

F. Younker, 16 North Michigan Avenue, Chicago, is having built a one-story factory, 100 x 100 ft., to cost $12,000.

Sigmund Greenblatt, Adams and Halsted streets, Chicago, is building a three-story addition for manufacturing purposes, to be 100 x 126 ft., and to cost $50,000.

A. Rohn is building a two-story factory, 60 x 113 ft., at 2016 West Lake Street, Chicago, at a cost of $18,000.

W. C. Griswold, 3616 Grand Boulevard, Chicago, manufacturer of drawn metal ware, has prepared plans for a two-story factory to cost $25,000.

The Automatic Air Furnace Company, Chicago, has been incorporated with a capital of $10,000 by R. W. Dunn, 10 South LaSalle Street, A. V. Brown and E. S. Thompson.

The Security Window Guard Company, Chicago, has increased its capital stock from $5,000 to $10,000.

Sears, Roebuck & Co., Chicago, are making additions to their plant at Arthington and Homan avenues, which will cost about $800,000.

The Warren Spark Plug Company, Chicago, has been organized with a capital of $1,000 by E. M. Furlong, George C. Mastin, 343 South Dearborn Street, and N. C. Putnam.

The Illinois Car Building & Repair Company, Chicago, has increased its capital from $1,000 to $2,000.

The Pendergast Wire Fence Works, Stillwater, Minn., has broken ground for a new factory.

The Crystal Ice Company, Fort Dodge, Iowa, will begin construction immediately of a $50,000 artificial ice plant.

The At Last Washer Company, Perry, Iowa, will erect an addition, 23 x 65 ft., to be used as a foundry. The latest machinery and equipment will be installed and the company expects to handle outside work as well as its own.

Detroit

DETROIT, MICH., May 29, 1916.

Dodge Brothers, Detroit, manufacturers of automobiles, have acquired additional property adjoining their plant, on which, it is announced, an addition will be erected.

Joseph N. Smith & Co., Detroit, manufacturers of automobile hardware, have acquired a site at Dubois Street and the East Boulevard, on which a new plant will be erected. The main building will be 120 x 313 ft., two stories; foundry, 38 x 120 ft.; tumbling room, 24 x 60 ft. and a powerplant, 22 x 34 ft., all modernly equipped.

The Fisher Body Company, Detroit, has taken out a permit for the erection of an addition to its plant to cost $10,000.

The Studebaker Corporation, Detroit, has purchased property adjoining its No. 3 plant, to provide for future extensions.

The American Radiator Company, Detroit, will erect a one-story brick addition to its plant to cost $12,000.

The Detroit Heating & Lighting Company, Detroit, manufacturer of sheet-metal specialties for automobiles, has com-

pleted plans for the erection of additional buildings to double its present capacity.

The Michigan Crown Fender Company, Ypsilanti, Mich., which has just completed a new plant, has found it necessary to provide for a second addition, 40 x 100 ft.

The Superior Mfg. Company, Ann Arbor, Mich., manufacturer of gasoline specialties, has acquired the plant of the Ann Arbor Piano Company to provide for its rapidly increasing business.

The Michigan Crank Shaft Company, Lansing, Mich., is erecting a small addition to its plant.

The Saginaw Motor Car Company, Saginaw, Mich., has been incorporated with $100,000 capital stock to manufacture automobiles and accessories. The incorporators include Henry E. Oppenheimer, John A. Cimmerer and William C. Wiechmann.

The Thornapple Gas & Electric Company, Hastings, Mich., is making extensive improvements to its steam plant, including the installation of 1000-hp. turbine engine and generator.

The Alma Standard Foundry Company, Alma, Mich., will remove its plant to St. Louis, Mich., where a new factory, 100 x 160 ft., will be erected.

The Superior Veneer & Cooperage Company will erect a new mill at Munsing, Mich., 54 x 170 ft.

The Globe Mfg. Company, Northville, Mich., will erect an additional building to provide for its rapidly increasing business. It manufactures automobile trucks.

The Thermophore Mfg. Company, Kalamazoo, Mich., has been incorporated with a capital of $60,000 and has taken over a plant at Ransom and Porter streets, where it will manufacture gas heaters.

The Holland Heating Company, Holland, Mich., has been organized by N. J. Yonker with a capital of $100,000, with $55,000 paid in. It plans to build a factory to manufacture heating furnaces.

Milwaukee

MILWAUKEE, WIS., May 29, 1916.

The capacity of Milwaukee machine-tool builders is still well taken up. Business the last half of May settled down to a steady tone, not unlike that of the period preceding the era of depression which made itself manifest in 1913. Those who came to the conclusion some time ago that the necessity for extraordinary extensions of facilities was past, when the enormous war contracts were well under way, now find themselves in the wrong. Numerous large projects are announced, among them being a $2,000,000 enlargement scheme of the American Brass Company at Kenosha, Wis.

Official notification has been received at the plant of the American Brass Company, Kenosha, Wis., that within two weeks there will be undertaken improvements which will involve an expenditure of from $1,600,000 to $2,000,000, and make the Kenosha plant the largest of its plants. At Kenosha work will start at once on a new brass foundry, 200 x 320 ft.; an addition to the rolling mill, 225 x 320 ft., to double the capacity of the plant. A new office building, plans for which are still indefinite, is also provided for. The work at Kenosha will be in charge of J. Robert Coe, chief engineer, Waterbury, Conn.

The Hudson-Sharp Machine Company and the Sectional Roll Mfg. Company, Green Bay, Wis., both producers of woodworking and paper mill machinery, have been consolidated under the name of the former company. The plant of the Sectional Company will be discontinued and the equipment moved to the Hudson-Sharp plant, which will be enlarged. The combined companies are in the market for considerable metal-working equipment, including lathes, shaping, grinding, drilling and planing machinery. The capital stock has been increased to $60,000 to accommodate the consolidation.

R. A. Boehme, Alma, Wis., and B. L. Bruggemann, Minneapolis, Minn., have formed a partnership to operate a machine shop and automobile business in the Boehme Building at Alma, which now is being remodeled for that purpose.

Bids will be taken until June 5 by William H. Dierken, city clerk, Reedsburg, Wis., for one horizontal tubular boiler for the waterworks plant.

The Four Wheel Drive Automobile Company, Clintonville, Wis., which has more than doubled the size of its motor truck works in the last eight months, will build another addition, 100 x 175 ft., to accommodate the new tractor department, organized from the Antigo Four Wheel Tractor Company, Antigo, Wis., which it has absorbed.

The Badger-Packard Machinery Company, 76 West Water Street, Milwaukee, new and used machine tools, factory equipment, etc., is preparing to take larger quarters at 141-143 West Water Street. The Badger Company is crowded for room and has been seeking better facilities for some months.

The Automatic Filer & Index Company, Green Bay, Wis., maker of steel and frame filing cabinets, cases, etc., has broken ground for a two-story addition, 40 x 100 ft. The plant will henceforth be driven by individual electric motors throughout.

Richland Center, Wis., is in the market for a simple high-pressure, non-condensing, heavy-duty Corliss engine and a 125-volt belted exciter with a maximum speed of 650 r.p.m., for the municipal electric light plant. Bids will be taken until June 6 by Reuben Sutton, city clerk.

Paul H. W. Pagel, operating a machine and smithing shop at Kaukauna, Wis., will build a garage and service station, 50 x 90 ft.

Indianapolis

INDIANAPOLIS, IND., May 29, 1916.

The Ross Machine Company, Lafayette, Ind., has purchased property and will erect a new factory building in the fall.

Gray & Son, Anderson, Ind., are building an addition to their factory at Eighteenth and Jackson streets, where they will install equipment for a general machine and tool manufacturing business.

The Lambert Mfg. Company, Anderson, Ind., is building a factory in Else Gundo, Cal., where it will manufacture tractors for the coast trade.

The Van Loon Pattern Company, Anderson, Ind., has been incorporated with a capital of $10,000 to manufacture wood and metal articles. The incorporators are Augustus T. Dye, John H. Osborne and John J. Van Loon.

The Wood Turret Machine Company, Brazil, Ind., is preparing to erect a factory addition, 80 x 101 ft., one story.

The Wayne Oil Tank & Pump Company, Fort Wayne, Ind., has filed notice of an increase in its capital stock from $500,000 to $700,000. It is about to build an addition to its works 400 ft. in length.

Cincinnati

CINCINNATI, OHIO, May 29, 1916.

A number of the larger railroad systems are taking surveys of their shops to ascertain what equipment is actually needed. This action, it is said, does not mean any immediate large purchases of shop equipment, but is merely a precautionary measure taken by the managers, who realize that their shops are handicapped by the lack of machine tools and other equipment. The present high prices for everything in which iron and steel enter are, of course, prohibiting much railroad buying just now.

The domestic demand for machine tools continues to improve, with the bulk of orders coming from the Central West and the East. Quite a number of orders for electric drilling machines have recently been received both from domestic and foreign sources. Most of the foreign business is from Russia. Nearly all local foundries are operating on full time, including stove makers. While considerable factory construction is under way in this vicinity at this time, most of the contracts were made before building materials had advanced to the present figures.

C. P. Golden, president Golden Foundry & Machine Company, Columbus, Ga., was in Cincinnati last week buying machine tools and other equipment. Later another addition will be made to the company's plant, for which equipment will be required.

The Sullivan Printing Works Company, Cincinnati, contemplates making an addition to its plant on Gilbert Avenue, 25 x 95 ft., three stories, and of reinforced concrete. Only special printing machinery and transmission equipment will be required.

The J. Baum Safe & Lock Company, Cincinnati, has been incorporated with $180,000 capital stock, by Walter J. Baum, and others. It operates a plant on East Front Street, and it is rumored that the manufacturing facilities will be increased at an early date.

The Champion Tool Works Company, Cincinnati, has secured an extension of its lease on a large site near Cleve-

Ohio, a suburb, but has not yet definitely decided about building its proposed new plant at that point.

The Altamont Springs Hotel Company, Fort Thomas, Ky., newly incorporated, will soon be in the market for equipment for a large bottling plant. J. C. Clutts is president.

The Dues Machine Company, St. Mary's, Ohio, was damaged by fire last week with a loss estimated at $8,000. A repair shop and garage were destroyed, but the main machine shop was saved.

The Concrete Steel Construction Company, Springfield, Ohio, has been awarded contract for the large steel foundry to be erected by the Blackwood Steel Castings Company at Springfield.

The Ohio Pipe Mfg. Company, Columbus, Ohio, has been incorporated with $10,000 capital stock by O. E. Harrison and others. Nothing is known as to manufacturing plans.

The Shaw Wire Fence Company, Columbus, Ohio, is preparing to move into a manufacturing building on Reynolds Avenue. It is having plans prepared for a new reinforced concrete factory to be completed this summer.

The Pomeroy Machine Shops Company, Pomeroy, Ohio, has let contract for an extensive addition to its plant.

The city of Wapakoneta, Ohio, will soon advertise for bids on a generator to be installed in the municipal lighting plant.

The Ohio Central Glass Company, Lancaster, Ohio, has been incorporated to take over the plant of the Cole Glass Company. It will be remodeled and special equipment added.

The Newark Stamping & Foundry Company, Newark, Ohio, maker of gray-iron castings, steel stampings and hose clamps, has let contract for another addition to its foundry. This is the second addition since Feb. 1. The stamping department is working double shift.

The Central South

LOUISVILLE, KY., May 29, 1916.

Business originating from outside of the territory immediately adjacent to Louisville is keeping the local machinery distributing and manufacturing plants busy on a capacity basis or better. No marked boom is to be found in and right around Louisville, although business is fully normal here. The outlook continues bright and orders on hand are accumulating. Projects for small electric light and power plants continue to develop frequently and repair work in all lines is producing an increased demand for parts.

The Louisville Cooperage Company, Twenty-ninth Street and Broadway, Louisville, will rebuild its plant, destroyed by fire at a loss of $150,000. J. N. White is president.

The Best Mfg. Company, which proposes to establish a factory, has been incorporated here with $200,000 capitalization, to manufacture electrical and other appliances for automobiles. It plans to rent factory accommodations temporarily. S. S. Fitzpatrick, A. T. Burgevin and George H. Turner are the incorporators.

Clyde Howard, of the Howard Shipyards Company, Jeffersonville, Ind., has announced that the company can take no more contracts for three months on account of inability to obtain steel.

The S. J. Gardner Foundry & Machine Company, New Albany, Ind., has contracted with Louisville and New Albany firms for four 6000-lb. electro-hydraulic plunger elevators.

Geiger, Fisk & Koop, Baxter and Hull streets, Louisville, manufacturers of drying machinery for distilleries, etc., are making improvements in their plant.

The Paducah Auto & Mfg. Company, Paducah, Ky., has incorporated, with $25,000 capital, to establish a repair shop for motor cars, etc. H. J. Jennings, R. M. Jennings, W. F. Magnum and A. H. Magnum are the incorporators.

The United States Cast Iron & Pipe Company, Louisville, has bought the property of the Providence, Ky., Water & Utilities Company, including the ice plant, at a master commissioner's sale.

Fire has destroyed the tipple and washer of the Durham Coal & Iron Company at the Coddy coal mine, near Chattanooga, with a loss estimated at $100,000.

George B. Adams, M. R. Stern and others have incorporated the Mills & Lupton Electric Supply Company at Chattanooga, Tenn., with $25,000 capital.

The Memphis Motor Car Co. will build a storage and service building for $35,000. W. F. Schultz is construction engineer.

At Knoxville, Tenn., D. R. Shearer, consulting engineer, is asking for equipment for a 600-hp. hydroelectric plant and a two-mile transmission system.

The Lenoir Car Works, Lenoir City, Tenn., is reported negotiating for a 30-acre site for the extension of its plant.

Birmingham

BIRMINGHAM, ALA., May 29, 1916.

Indications point to quicker action on machine tools, owing to an apparent letting up in the foreign demand. The general run of wholesale hardware is fair to good, and greatly above the same period last year.

The E. E. Jackson Lumber Company, Baltimore, Md., has let contract to Sawmill Construction Company, Savannah, Ga., to build at Riderwood, Ala., a sawmill with daily capacity of 150,000 ft., eight dry kilns, etc. The equipment will include four water-tube boilers of 500-hp. each.

The American Box Company, Cleveland, Ohio, will build veneer and box factory at Demopolis, Ala.

James S. Bradley, Jr., Brunswick, Ga., announces that the Yaryan Rosin & Turpentine Company will build a pulp mill to cost $250,000.

The J. B. McCrary Company, Atlanta, Ga., has charge of plans for the development of water power on broad River near Royston, Ga. Bonds for $300,000 will be issued.

The Broad River Hydroelectric Company, Cliffside, N. C., has been organized by Charles H. Haynes, Barron Caldwell and others to build a power plant on the Broad River. The capital stock is $500,000.

The Interborough Power Company, Spartanburg, S. C., has been organized by A. M. Law, C. R. Willard and others to build a 4000-hp. hydroelectric plant on the Tyger River, with a capital stock of $100,000.

The Boone's Fork Lumber Company, Shull's Mill, N. C., will build a 600-hp. hydroelectric plant to generate power for its saw and planing mills, etc.

The L. B. Skinner Mfg. Company, Dunedin, Fla., suffered the loss of its foundry and a large number of patterns by fire May 5. The building has been replaced and the machinery, which was nearly all salvaged, has been installed and operations are now under way. B. C. Skinner is manager.

St. Louis

ST. LOUIS, MO., May 29, 1916.

Machine-tool business continues heavy, with the demand still more than equaling the supply. The extreme pressure, however, is steadily easing off. Investment capital is proving quite plentiful, with new enterprises readily financed whenever equipment can be assured. Commercial loans are easy, though there is some indication of a tightening of rates, though no marked advance is expected. Collections are very good.

The J. C. C. Waldeck Electric Railway Company, St. Louis, Mo., has been incorporated with a capital stock of $50,000 to build an electric railway and install equipment for the switching work of the Waldeck packing plant of which J. C. Waldeck is president.

The Barks & Barstow Mfg. Company, Valley Park, Mo., manufacturers of steel roofing and specialties, will erect a new factory.

The John Clemens Sheet Metal Company, St. Louis, Mo., has been incorporated with a capital stock of $13,500 by John Clemens, Oscar Luedde and B. M. Clemens to do a general sheet-metal business.

The G. A. Hasemann & Sons Mfg. Company, St. Louis, Mo., has been incorporated with a capital stock of $10,000 by G. A. Hasemann and others to manufacture store and office fixtures.

The Sinclair Oil & Refining Corporation, Tulsa, Okla., is completing plans for the equipment of a large oil refinery near St. Louis. A pipe line with pumping stations, etc., is to be laid from the Tulsa oil fields to Chicago by way of St. Louis.

The Barks & Barstow Mfg. Company, St. Louis, Mo., will erect a machine shop requiring about $8,000 of machinery.

The Acton-Parke Automobile Company, Kansas City, Mo., has been incorporated with a capital stock of $50,000 by C. B. McLaughlin, Henry C. Page, S. C. Nelson.

The St. Joseph Lead Company, Bonne Terre, Mo., has plans for the equipment of a power plant to cost about $250,000.

The Cordia Timber Company, Potosi, Mo., E. F. Cordia, manager, has acquired a 24,000-acre timber tract on which it will install mill.

The prison commissioner, Joliet, Ill., will receive bids on 1200 hp. of boiler capacity for the penitentiary. The chief engineer of the penitentiary at Joliet has the specifications.

R. P. and G. W. Hart, Arkadelphia, Ark., will equip a cotton ginning plant, requiring four 70-saw units to cost about $4,000.

The Arkansas Hydroelectric Development Company, Heber Springs, Ark., has plans in preparation for the erection of two hydroelectric plants of about 54,000 hp. in all. Dickinson & Watson, Little Rock, Ark., are the engineers in charge. The ultimate investment is put at $5,000,000.

The Rockwell Mfg. Company, Camden, Ark., has plans for the addition of considerable wood-working machinery to its screen-manufacturing plant.

The Kusa Ice, Light & Power Company, Kusa, Okla., with headquarters in the Republic Bldg., Kansas City, Mo., is in the market for two 75-kw. direct-connected units and two 30-ton refrigerating machines.

The Roxanna Petroleum Corporation, Tulsa, Okla., has plans for an oil refinery at New Orleans, La., also the equipment of a pipe line, pumping plants, etc., to connect the refinery with the Oklahoma oil fields. An increase of capital from $10,000,000 to $50,000,000 is planned.

Commerce, Okla., will install waterworks plant equipment at a total cost of about $31,000, including air lift equipment, duplex power pumps, electric power equipment, etc.

Henryetta, Okla., will proceed at once with waterworks plant equipment extension at a total cost of about $95,000, including filters, pumping machinery, etc.

Oklahoma City, Okla., has voted $1,500,000 for a waterworks system, of which about $1,000,000 will be devoted to a reservoir and the rest to plant equipment.

The Lumber-Mineral Company, Arbo, Miss., will rebuild and re-equip its plant, recently burned with a loss of $80,000. Detailed plans are being rushed to completion for bids.

The Bolinger-Franklin Lumber Company, Shreveport, La., S. H. Bolinger, president, will equip a double bandsaw mill near Kosciusko, Miss., with a daily capacity of 100,000 ft.

The B. A. Parnell Lumber Company, Schamberville, Miss., will rebuild its burned mill, with a capacity of 75,000 ft. daily.

The Summit Lumber Company, Randolph, La., will rebuild its mill and power plant recently burned with a loss of about $40,000.

Catalogs Wanted

The Oklahoma Discount Company, 710 South Seventh Street, Chickasha, Okla., desires catalogs of coining presses and steel dies.

The Pacific Northwest

PORTLAND, ORE., May 23, 1916.

Activity in the lumber trade is reflected in almost every other line of business in the Columbia River and Puget Sound cities. Portland bankers report the greatest activity in financial transactions in the history of the city. The increasing demand for manufactured products, and the tendency toward equalization of labor conditions between the East and Pacific coast, are leading to the establishment of new plants in this vicinity by both Eastern and local interests. Metal-working plants are now working near capacity, lumber mill equipment being one of the most important items, while mining and dredging machinery, both for Alaska and the interior, is occupying a number of shops, and the volume of marine work is increasing. Many wooden vessels are being built, which require marine engines and elaborate hoisting and accessory equipment. All the paper mills in this district are making additions, and Japanese concerns are placing large orders for American paper mill machinery. Machine-tool business consists mostly of single tools and small groups, but the aggregate is large and includes a few substantial orders.

Bids have just been taken for the construction of the blacksmith boat and plate shops for the new shipbuilding plant of the Northwest Steel Company and the Willamette Iron & Steel Works at Portland. A contract for the construction of shipways will also be placed shortly. Contracts have been closed for the construction of four steamers in the new plant.

The port commission of Seattle, Wash., has placed an order for a locomotive crane to be used in handling cargo on the waterfront.

The Hawley Pulp & Paper Company, Oregon City, Ore., which is building a new unit to its plant, is considering plans for still another addition, which would increase its daily output to 150 tons.

The American Can Company, which recently purchased a large block of land in Seattle on which a plant will be established, has submitted preliminary plans.

The port commission, Bell Street Dock, Seattle, will receive bids until June 7 for a locomotive crane.

The Enthridge Lumber Company, Helena, Mont., has filed articles of incorporation, with capital stock of $[illegible],000.

The Oregon Potash Company, Portland, has filed articles of incorporation, with capital stock of $100,000, and Arthur C. Burgess, T. B. Mohler and Earl H. Fry, incorporators. It will establish a plant to extract potash from kelp, fertilizer from fish refuse, etc.

The Chicago, Milwaukee & St. Paul Railroad has announced its intentions of constructing a sawmill at Morton, Wash., which will have a capacity of 160,000 ft. daily. The company owns extensive timber lands in Lewis County.

The General Machinery Company, 315 Stevens Street, Spokane, plans the construction of a warehouse at Freya and Riverside streets.

The Great Falls Ornamental Iron & Wire Works, Great Falls, Mont., has been incorporated for $10,000 by John N. Fisher, Adrian Jutte and Ture Bjork. It will establish a plant in Great Falls.

The Hammond Lumber Company, Astoria, Ore., has purchased a tract of tidelands on which it will establish a sash and door factory.

The Kittitas Lumber Company, North Yakima, Wash., plans the erection of a lumber mill with a daily capacity of 40,000 ft. It has purchased more than 25,000,000 ft. of logs from the United States Government.

Fletcher Linn and W. E. Flanders, Portland, Ore., have taken over the plant of the Union Furniture Mfg. Company, which they will remodel and reopen. The three old structures will be rebuilt into one new building, 50 x 200 ft., and new machinery installed.

The Peninsula Shipbuilding Company, Portland, Ore., which is constructing a shipbuilding plant in that city, has recently elected F. C. Knapp, president, and James B. Kerr, secretary.

Canada

TORONTO, May 29, 1916.

Steel shipbuilding is being inaugurated in Nova Scotia. Work on the erection of a shipyard had already begun near New Glasgow. The site for this industry is below the plant of the Eastern Car Company's works, on the east river of Pictou. The first steamer to be built will be for the Nova Scotia Steel & Coal Company, under whose auspices the industry is being inaugurated.

Canada's total trade for April, 1916, reached the remarkable total of $106,585,334, as compared with $65,221,031 for the corresponding period of the previous fiscal year. The increases are shown in both exports and imports. Merchandise entered for consumption amounted to $50,147,830, as compared with $28,391,640. These imports show a substantial increase in the free list, as well as in the dutiable goods, the free imports increasing from $11,776,319 to $21,218,746.

Winnipeg, Man., will apply to the Dominion Government for a lease of Slave Falls on the Winnipeg River in order to make further extensions to the city's power department.

St. John, N. B., proposes to make extensions to its waterworks plant and system to cost $230,000.

Large extensions being made to the plant of the Clayburn Firebrick & Clay Company, Ltd., Clayburn, B. C., will require machinery to double the capacity of the plant. W. H. Armstrong is president.

Fire caused $30,000 damage to the factory of Louis Winstainer & Son, manufacturers of picture frames, at 58 St. Lawrence Boulevard, Montreal.

A one-story concrete building, 70 x 90 ft., is being built by Bauman & Letson, Elmira, Ont., to replace their planing mill recently destroyed by fire.

The Helm's foundry at Port Hope, Ont., has been taken over by the Port Hope Machine & File Works, and will be equipped with special machinery for re-cutting files.

The Hull Iron & Steel Foundries, Ltd., Hull, Que., is building an addition, 90 x 150 ft., to its foundry, at a cost of $30,000, to be used as a small castings department.

The Joliette Steel Company, Joliette, Que., has purchased a building which is being remodeled for the manufacture of castings by the converter process.

The Standard Chemical, Iron & Lumber Company, Fassett, Que., is building a new factory to replace the one recently destroyed by fire with a loss of $75,000.

The Peerless Weaving & Belting Company, Ltd., has leased the factory of Ludlam-Ainslie Company, Arthur Street, Hamilton, Ont., and will install machinery for the manufacture of leather belts, automobile accessories, etc. The directors of the company are Edward de Ette Matteson

and Jacob Dilcer of Buffalo, N. Y.; W. F. Frantz, Colden, N. Y., and Edward F. Gingras of the Peerless Belting Company, Gardenville, N. Y., who will be superintendent of the Canadian plant.

Orillia, Ont., will complete its power plant at Swift Rapids, which will cost $90,000. C. E. Grant is clerk.

A by-law has been passed by Campbellford, Ont., to grant a loan of $30,000 to assist the Northumberland Paper & Electric Company to erect a new plant, to replace one recently destroyed by fire.

The Standard Steel Construction Company is building a factory and warehouse for the Canada Forge Company, Ltd., at Welland, Ont., to cost $50,000.

L. Frick & Son, Simcoe, Ont., will be in the market for the following machinery for a planing mill which is being erected there: Planer, sticker, re-saw, rip-table, one 40-hp. motor, shafting, belting, etc.

The Williston Steel Foundry, Ltd., Halifax, N. S., is building a foundry at Dartmouth, N. S., for the manufacture of crucible steel castings. The furnaces to be installed will be of the patent tilting design, using coke for fuel under forced draft. The plant will cost $16,000.

The R. M. Ballantyne Company, Ltd., Stratford, Ont., will build a power plant at a cost of $10,000 and will install new engines, boilers, and other accessories.

The controlling interest of the Maple Leaf Auto & Supply Company, Hamilton, Ont., has been secured by W. Ellis, who is having a plant erected on Barton Street for the manufacture of metal garages, gasoline tanks, automobile parts, metal specialties, etc. H. J. Wise is manager.

The Du Pont Powder Company has completed arrangements for a $10,000,000 subsidiary company which will operate exclusively in Canada. The company has secured a water power and other properties on the Saguenay River in Quebec and will commence the erection of a plant at an early date. The product of the company will be nitrogen, which in due time will be applied to the manufacture of high explosives at the company's plant in the United States.

The McArthur Beltings, Ltd., Brockville, Ont., has been incorporated with a capital stock of $40,000 by James D. McArthur, John S. McArthur, Cecil N. Palmer and others to manufacture leather, beltings, etc.

The Shimer Cutter Head Company of Canada, Ltd., Galt, Ont., has been incorporated with a capital stock of $50,000 by Frederick H. Palmer, Edward M. Worth, Robert Pollock and others to manufacture cutter heads, machine knives, etc.

The National Wood Mfg. Company, Ltd., South River, Ont., has been incorporated with a capital stock of $125,000 by William J. Ard, Clinton A. Jackman, Albert Howard and others to manufacture wood articles, lumber, etc.

The Canada Fire Hose Company, Ltd., Montreal, has been incorporated with a capital stock of $40,000 by Sagfried H. R. Bush, Joseph S. Lamarre, Edward C. Baker and others to manufacture fire extinguishers, apparatus, hose, machinery, etc.

The Dominion Ivory Company, Ltd., Toronto, has been incorporated with a capital stock of $50,000 by Silas S. Kenyon and Howard R. Bemis, both of Springfield, Mass.; Edwin J. Levine of New York, N. Y.; Newton O. Harvey of Toronto, and others, to manufacture ivory articles, imitation ivory, etc.

The Canada Clock Company, Ltd., Toronto, has been incorporated with a capital stock of $250,000 by Ernest M. Dillon, 33 Richmond Street West; Harold H. Frost, 38 Victoria Avenue; Henry E. Grisch, 208 Grace Boulevard and others.

The McLean-Simpson Company, Ltd., Toronto, has been incorporated with a capital stock of $50,000 by James W. McLean, 115 Beatrice Street; Melvin G. Hunt, 414 Confederation Life Building; George A. Tuckey, 2 Milbrook Crescent and others to manufacture office furniture, etc.

The Sanitary Heating & Ventilating Company, Ltd., Ottawa, has been incorporated with a capital stock of $50,000 by Alfred E. Adams, Otto G. J. O'Regan, Joseph H. Barket and others to manufacture electric and heating appliances, etc.

The Nor-West Farmers Co-Operative Lumber Company, Ltd., Vancouver, B. C., has been incorporated with a capital stock of $100,000 by John H. Senkler, George C. Van Horne, Montague G. Caple and others.

P. Baillargeon, Ltd., Montreal, has been incorporated with a capital stock of $100,000 by Arthur R. Whitney Plimsoll; Reigner Brodeur; Linton H. Ballantyne, Westmount, Que., and others to manufacture ice-cutting and ice-handling tools, etc.

The Canadian Drawn Steel Company, Ltd., Hamilton, has been incorporated with a capital stock of $500,000 by Robert K. Hope, Henry J. Waddie, Sanford D. Biggar and others to manufacture steel, iron, metals, etc.

The Studebaker Corporation of Canada, Ltd., Walkerville, Ont., has been incorporated with a capital stock of $400,000 by Charles D. Fleming of Detroit, Mich., Alexander Leslie, Hugh L. McDowell and others to manufacture automobiles, etc.

C. Tessier, Box 965, Pembroke, Ont., is in the market for a compound marine steam engine, high pressure cylinder, about 5 x 7-in. stroke.

Government Purchases

WASHINGTON, D. C., May 29, 1916.

The Treasury Department, office of the electrical engineer in charge of automatic scales, Washington, D. C., will open sealed proposals 3 p. m., June 14, for furnishing and installing one complete automatic weighing and recording scale from specifications furnished by the chief engineer.

The U. S. Reclamation Service, Denver, Col., will receive proposals for the power and pumping equipment for the Grand View Irrigation District, Yakima project, Washington, June 15, not June 5, as was stated in THE IRON AGE of May 25.

Sealed proposals will be received by the Department of the Interior, Washington, until 2 p. m., June 6, for furnishing f.o.b. cars factory one standard 5-ton gasoline motor truck with special equipment.

Bids were received at the Bureau of Supplies and Accounts, Navy Department, Washington, May 23, for material for the naval service, as follows:

Schedule 9567—Steam Engineering

Class 11, Mare Island—One engine lathe. Bid 23, $1,183.30; 49, $1,244.50; 67, $1,104, $1,133, $1,307 and $1,342; 68, $1,350; 78, $1,052; 89, $1,308; 94, $1,338 and $1,378; 103, $1,310; 107, $1,548; 135, $1,323; 151, $1,305 and $1,070; 154, $1,128.

Schedule 9576—Construction and Repair

Class 31, Mare Island—One automatic towing chock—Bid 64, $810.

Schedule 9568—Steam Engineering

Class 41, Boston—One electric welding and cutting outfit—Bid 37, informal; 141, $915; 149, $2,947.

Class 42, Brooklyn—One electric welding apparatus—Bid 37, informal; 141, $915; 149, $2,947.

Class 43, Puget Sound—One electric welding and cutting outfit—Bid 37, informal; 141, $960; 149, $2,025.

Schedule 9602—Construction and Repair

Class 57, Brooklyn—One punch and shear, motor-driven—Bid 20, $3,293; 60, $5,075 and $4,975; 107, $4,075 and $4,100; 142, $3,581.25.

Class 58, Brooklyn—Two punches, motor-driven—Bid 107, $1,865 and $1,640; 142, $2,247.50.

Class 59, Brooklyn—One bolt-heading machine, belt-driven—Bid 1, $1,610; 94, $1,565 and $1,730; 103, $1,454; 107, $1,450; 142, $2,490.

Schedule 9603—Steam Engineering

Class 61, Norfolk—One molding machine—Bid 92, informal; 99, $964.85.

Schedule 9605—Construction and Repair

Class 72, Boston—One hydraulic trimming press—Bid 18, $3,500; 43, $645; 94, $1,520; 118, $625; 140, $1,150; 143, $450; 150, $1,419.

Class 73, Boston—One 2000-lb. steam drop hammer—Bid 27, $5,174; 94, $2,870, $2,470 and $4,620; 103, $4,372, $4,892, $3,830 and $4,205.

The names of the bidders and the numbers under which they are designated in the above list are as follows:

Bid 1, Ajax Mfg. Company; 18, Bethlehem Steel Company; 20, Bertsch & Co.; 23, Berger & Carter Company; 27, Buffalo Foundry & Machine Company; 37, C. & C. Electric & Mfg. Company; 43, Charles F. Elmes Engineering Works; 49, Federal Sales & Service Company; 60, Hilles & Jones Company; 64, Hyde Windlass Company; 67, Harron, Rickard & McCone; 68, Hamilton Machine Tool Company; 89, Morris Machine Tool Company; 92, Mumford Molding Machine Company; 94, Manning, Maxwell & Moore, Inc.; 99, E. H. Mumford Company; 103, Niles-Bement-Pond Company; 107, D. Nast Machinery Company; 118, Sherritt & Stoer Company; 135, Universal Trading Company; 140, Watson-Stillman Company; 141, Siemund Wenzel Electric Welding Company; 142, Williams, White & Co.; 143, Southwark Foundry & Machine Company; 149, Wilson Welder & Metal Company; 150, William H. Wood; 151, Fred Ward & Son; 154, Eccles & Smith Company.

World Questions and Co-operation

American Iron and Steel Institute Meeting

(*Continued from page* 1337)

any two furnaces built on the same identical lines using the same materials that have given the same uniform performance over such a period of time that these two furnaces have. From observations made of the distribution of the stock on the large bell and in the furnace, before blowing in any furnace equipped with this modified top, we are certain that there is obtained as near an ideal filling as is possible with any mechanical blast furnace top. Using a large bell having a diameter 4 ft. less than that at the stock line, the materials lodge ideally in the furnace, with a maximum of fines at the wall and a diminution of fines and a corresponding increase in lumps toward the center of the furnace.

As further proof of the value of the good distribution obtained, I would call attention to the work on Nos. 4 and 5 furnaces before, as compared with that after the present tops were installed:

Furnace Performance as Affected by Modified Top

Furnace	Month Following Blow-in Month: Blown in	Av. Daily Tonnage	Av. Coke, Tons	Type of Top
No. 5, Sept. 2, '09		311.0	3,190	Original Brown
No. 5, July 8, '11		317.3	2,859	Original Brown
No. 5, July 10, '15		332.7	2,604	New type
No. 4, June 6, '07		183.9	3.331	Old style modified Brown
No. 4, Jan. 1, '13		386.1	2,542	Old style modified Brown
No. 4 April 4, '16		410.4	2,250	New style

FURNACE CHARGING CHART

The spout of the distributor revolves 64 deg. while the skip car travels once from skip pit to top. It is possible to fill the stock in a great many combinations, depending upon the number of skips of coke, ore and stone used to constitute a charge. We have tried all the practical combinations to prove out the best one. Although realizing the ideal at all times, we were hampered to a great extent by the stockhouse equipment, which consists of two sets of bins paralleling each other, one of wood and one of steel construction. This equipment prevented us from making the coke charge less than 12,000 lb. and still keep the furnaces filled so as to get the proper reduction of the stock column. Our standard coke unit is therefore usually 12,000 lb. Every mixture is planned on a concentric circle chart, here reproduced, laid off in degrees corresponding to the travel of the spout of the mechanical top. A complete cycle is then mapped out and the position of the raw materials are changed until we get the best possible distribution of all materials in each sector of the furnace. One may note in following the position of the raw materials that the ores, slags and stone are uniformly spaced.

For every six trips of the skip there is an overlap of 24 deg. more than a complete circle, and as 10 skips constitute one charge, it thus takes 9 charges of coke, stone and ore, or 90 trips of the skip to bring the spout back to its original starting point. With certain ore mixtures, it sometimes happens that a given ore is not absolutely uniformly distributed as far as each sector is concerned when a cycle is completed. To prevent the recurrence of this error, the second cycle is started 64 deg. in advance of the first by moving skip car empty for one trip. This is shown by the inner circle. By doing this, all grades of materials are charged into the furnace in such a manner as to form a uniform spiral column. After deciding the method of filling a given mixture, complete information is furnished the stockhouse foreman.

BY H. S. BRAMAN

Superintendent blast furnaces and steel department, Youngstown Sheet & Tube Company, Youngstown, Ohio.

No matter how much care and how perfect the distribution on the large bell may be, it is quite possible to undo all the good efforts by having uneven surfaces on the stock line. Many different constructions have been used and some of the common ones are as follows: Cast-iron bricks, laid alternately with hard-burned bricks; hard-burned firebricks alone; cast-iron angles laid in firebricks; plain cast-iron wearing plates, and water-cooled cast-iron wearing plates. Of the different constructions we use the water-cooled cast-iron plates and find that in most cases the cast-iron plates outlive the furnace and hence give a surface which can absolutely be depended on.

Poor coke, irregular ore, dirty limestone, etc., all have their effect on furnace operation and cannot be entirely overcome by perfect distribution or any one way of filling. We have found that after filling one way for some time, six weeks or so, the furnace works sluggishly and somewhat irregularly, due no doubt to channeling of the gases. A change of filling will allow new channels to be formed and a general cleaning up is apparent. Our standard method of filling is very much the same as that mentioned by Mr. Vreeland. This gives very good results for about six weeks, when it becomes necessary to change. After five days or as soon as the cleaning up ceases somewhat, we again go back to the standard filling and find that the furnace travels with renewed activity.

Inspection of our distribution on top by our operatives is another instance where the human element is quite as essential as a perfect automatic mechanism itself. Through the cleanout and inspection doors on top of the furnaces, our men are able to observe and measure stock distribution on top of the large bell. Occasionally sticky ores adhere to the bell and are not discharged upon lowering. Furnace rounds coming on top are therefore deflected in their course and unless frequent inspection trips are made, much trouble will be experienced.

BY RALPH C. GLAZIER

Cambria Steel Company, Johnstown, Pa.

The actual production of flue dust since the installation of the Slick distributor is less than half of that made formerly, and the amount of fine Mesaba ores which can be used is greater. For the same reason the blast pressures, top temperatures and coke consumption are lower with consequent further economies and ease of operation.

The following table gives results obtained on two furnaces similarly equipped except for the Slick distributor:

Usual Bell and Hopper, No Distributor. No. 4 Furnace, Six Months, January to June, 1914		Usual Bell and Hopper with Slick Distributor. No. 5 Furnace, March, April and May, 1915	
Ore Used	Per Cent	Ore Used	Per Cent
Mesaba	44.5	Mesaba	49.8
Mesaba (Mahoning)	10.5	Mesaba (Beaver)	44.0
Old Range	42.2	Old Range	...
Flue dust	2.8	Flue dust	6.2
	100.0		100.0
Flue dust produced per ore charged, per cent	8.02	Flue dust produced per ore charged, per cent	3.65

Prior to the use of the Slick distributor, as this table shows, the charge consisted of more than 42 per cent of Old Range ores, in order to obviate, as far as possible, the slips and excessive production of flue dust. After the Slick distributor was installed, the Old Range ores were discontinued in the case shown and 100 per cent of fine materials composing the iron bearing portion of the charge were used. This included 49.8 per cent of miscellaneous fine grain Mesaba ores, 44 per cent of Mesaba Beaver ore, which is very fine, showing 15 per cent through a 100-mesh sieve, with other fines in proportion, together with 6.2 per cent of flue dust. Despite this fine mixture the flue dust production was less than half.

That the results shown on No. 5 Furnace in the preceding table have also been achieved on the other furnaces at Johnstown, since they were equipped with the Slick distributor, is shown by the fact that the flue dust production on Cambria Steel Company furnaces for the first four months of 1916 is 153 lb. per ton metal produced or about 3.6 per cent of the ore charged. The decreased amount of dust not only shows a marked saving in the yield of mixture but aids in the operation and lessens repairs and maintenance of stoves and boilers when unwashed gas is used.

By-Products Recovered in Coke Manufacture

BY WILLIAM HAMLIN CHILDS
President Barrett Company, New York

GERMANY and England have found coal by-product industries of vital importance to them in the present crisis, not only because they are essential to the steel industry but also because they are the great source of benzol, toluol, phenol and other chemicals used in the manufacture of explosives. Not only this, but in our case they are the only operating native source of combined nitrogen, from which nitric acid, so absolutely necessary in making explosives, can be made. The only alternatives are the roundabout and costly method of atmospheric nitrogen fixation, or the importation of Chilean nitrate, the last of which might be cut off in time of war. These facts are but little known to the general public or apparently to the members of Congress.

The various primary by-products by themselves are, in order: ammonia, gas, benzol, cyanogen and tar.

AMMONIA

Ammonia is important in chemical manufacture, in refrigeration and, as already mentioned, as a source of nitric acid for explosives manufacture in war time, but its great field is as an agricultural fertilizer. A 4-ft. vein of coal will yield enough sulphate of ammonia to fertilize the land lying above it for 1000 years.

To be more specific, coal contains from 1 per cent to 1½ per cent of nitrogen. At the minimum figures this should yield 80 lb. of sulphate of ammonia per net ton of coal, whereas the usual yield in by-product ovens is one-fourth as much or a little more. This is due to the unfortunate fact that when coal is distilled, the nitrogen is distributed among the products of distillation, the bulk of it, usually more than half, remaining in the coke. The remainder goes into the tar, or into cyanogen, or as ammonia into the liquor and gas, there being also a possibility of loss as free nitrogen by ammonia dissociation. The distribution varies with the coal, a high nitrogen content not necessarily meaning a high ammonia yield.

Many attempts have been made, mostly in gas retort practice, to increase the yield of ammonia from coal, in view of the large amount of nitrogen retained in the coke. The most promising of them seems to be the mixing of a little less than 2 per cent of caustic lime with the coal to be carbonized. Results for a year at an English gas works showed a gain of 1.68 lb. of sulphate of ammonia per net ton coal, the operations being benefited rather than otherwise.

Some of the German plants put out a dried and ground sulphate, which, being entirely deprived of moisture by kiln drying, tests over 25.25 per cent NH_3 and brings a slightly higher price. A corresponding grade is made in this country. It has a great advantage over other nitrogenous chemicals used for fertilizers in its fine mechanical condition, which makes it spread evenly by hand or in a grain drill or spreader. It is a question for serious consideration whether it would not be a wise measure to treat all the sulphate made in this way, in order to set a high standard in view of possible German competition after the war.

It is of interest to note in this connection that the large consumption of fertilizer is in the South Atlantic States—Georgia, the Carolinas and Alabama—while the main production of sulphate of ammonia, aside from the Birmingham district, seems likely to be in the Chicago-Pittsburgh region. This involves a considerable rail haul to the point of consumption. The Western grain States, which would naturally draw from Chicago, have not come to use fertilizer to any extent. When the demand for fertilizer develops there, as it will in time, the production will be at an advantageous position relative to other sources of supply.

GAS

Coke-oven gas is, in a way, the joker among the cards in the by-product coke man's hand. It may be worth a great deal for illuminating purposes, or it may be worth only its fuel value as against coal under steam boilers. In the first instance it brings from the consumer let us say, about 60 cents per thousand cubic feet, or, allowing for purification and distribution, about 30 cents net. For fuel under boilers the usual price is about 4 cents per thousand, depending on the price of the coal it displaces. Modern coking practice easily recovers 6000 cu. ft. of surplus gas per ton of coal carbonized. At 30 cents this would be $1.80 per ton of coal, as against a credit of 24 cents which would be the other extreme. Where a new plant is under consideration there is an ample reward here for wise planning and successful negotiation. Unfortunately, success in finding such a market for the gas is in many cases a difficult matter.

For example, a modern plant of say 40 ovens, which is about the minimum and corresponds to a 400-ton blast furnace, would produce about 3¼ million feet of gas per day. This under ordinary circumstances would supply a city of at least 150,000 inhabitants. There are only 26 cities of this size in the United States east of the Rocky Mountains, and all of these are supplied with gas, some of them with coke-oven gas. There are already upward of 46 by-product coke-oven plants in existence, and some under construction.

The calorific power of the gas will average between 580 and 620 B.t.u. per cubic foot and the candle power from 12 to 16. The lead or oven heating gas has in the neighborhood of 500 to 580 B.t.u. As the coking period has decreased to between 16 and 20 hr. in the latest ovens, the heat efficiency of the oven has increased, and with it the amount of surplus gas, but as the rich fraction is taken over a longer time the quality of the gas is necessarily somewhat lower.

It is usual to estimate 11,000 cu. ft. of gas from a ton of coal, of which 5000 or less will be required for coking and 6000 ft. or more will be available surplus. Authentic reports are at hand which show a yield from a recent coke-oven plant of over 12,000 cu. ft. of gas per net ton of coal, containing less than 5½ per cent of carbonic acid and nitrogen. Of this gas less than 40 per cent of the heat value was used in coking, so that the surplus corresponded to 7200 cu. ft. The coal was a mixture of 40 per cent low volatile and 60 per cent high volatile coal, which would average about 30 per cent volatile. The total amount of heat lost in waste gases and radiation at this plant was less than 4½ per cent of the total heat in the coal.

One important use, namely, for power development in gas engines, has not received the attention in this country that it has in Europe. So far as information is available, the only large gas engine installation using coke-oven gas in this country is at Lebanon, Pa., where four 1200-hp. engines using gas from the Semet-Solvay plant there develop electrical power for operating the Cornwall Ore Banks. According to published data, gas engines aggregating over 200,000 hp. for operation with coke-oven gas have been installed in Europe by three of the principal builders since the year 1904. A guarantee of 1 hp. per hour with 27 cu. ft. of average gas is not considered out of the way, which would mean about 200 hp.-hr. per ton of coal, or for each modern coke-oven the capacity to produce 125 hp. continuously, as long as it is in operation. A battery of 80 ovens would yield 10,000 hp.

BENZOL, TOLUOL AND XYLOL

The recovery of benzol, together with its homologues, toluol and xylol, is more properly dealt with in connection with the gas than with the tar, as by far the larger portion of these oils is found in the gas, although chemically they are classed with the coal tar derivatives. There is, of course, no exact proportion, but a recovery of 2½ gal. of light oil from the gas from 1 ton of coal carbonized is common, while the

corresponding fraction of the tar would probably be less than one-tenth of a gallon.

The actual recovery of benzol is a relatively simple matter. It is based upon the property of certain high boiling oils to absorb the crude benzol vapors from the gas, and to yield them up again when heated to a temperature below their own boiling point. The oils employed for this washing are the so-called petroleum straw and tar creosote oil.

The washing of oven gas with oil for benzol is practically parallel to the washing with water to recover ammonia, the guiding principle being to bring the gas into intimate contact with a maximum surface of the cool washing liquid. The benzolized oil passes from the washer through a preliminary heater to the still, where the benzol vapors are driven off by a combination of direct and indirect steam. The exit oil is cooled and returned to the benzol washers, while the benzol vapors pass to the condenser and are delivered as light oil. This contains possibly 10 to 15 per cent toluol, and 45 to 55 per cent benzol, with small amounts of xylol and naphthaline.

In the United States most of the coke oven plants that make illuminating gas have until recently found a good market for their benzol by leaving it in the gas to increase its candle-power. But even where the gas was used exclusively for fuel the operators have been slow to install benzol recovery plants because of the limited demand in chemical manufacture, and the low price of gasoline, which now occupies the field as a motor fuel.

Until the war demands for benzol and toluol arose, their chief uses in this country were as solvents for rubber, in paints and varnishes, paint and varnish removers, grease extraction, imitation leather, and as a basis for making other chemicals, as aniline, benzoic acid, saccharin, etc.

Toluol, the basis of trinitrotoluol, or T.N.T., now the most fashionable explosive in European war circles, jumped from 30 cents a gallon to $4.50 or upward. Benzol, in moderate but increasing demand at 25 cents a gallon, suddenly climbed to 80 cents as the basis of synthetic phenol, an essential in making picric acid, and for the manufacture of aniline oil—an important factor in the dyestuff industry.

The estimated figures for the production of light oils from gas washing, so far as they are obtainable, indicate that in 1914 about 6,000,000 gal. were made, and in 1915 about 14,000,000 gal. For the year 1916, if all the existing works and those expected to come into operation are kept in service, it is expected that the output will exceed 22,000,000 gal. If we assume that all the metallurgical coke now used was made with benzol recovery, the quantity of refined benzol available would be upwards of 100,000,000 gal. per year. Under such circumstances it would have to be used as a motor fuel, on the same basis as gasoline.

As a motor fuel 90 per cent benzol is actually 20 to 25 per cent more efficient per gallon than gasoline, a statement that has been demonstrated by numerous tests on the road, the only difference in operation being a slight adjustment of the carburetor. A mixture of gasoline and benzol can be used without carburetor adjustment, and with both convenience and economy.

TAR

Although the by-product oven is now the most important source of coal-tar, the broader development of the tar industry awaited the advent of by-product coking. A very substantial industry had arisen, having gas works tar as its raw material and having roofing materials as its principal products.

The portion of tar that can be used in making synthetic dyes and chemicals is only 10 per cent of its whole composition. I cannot over-emphasize the fact that the continued growth of the tar industry, and its ability to take care of the largely increased supplies that are already in sight, depend entirely upon the disposal, at profitable returns, of the two principal items that constitute the great bulk of the product of tar distillation, viz.: pitch and creosote oil. Without the use of creosote oil for wood preservation, it is doubtful if the industry of tar distilling could have been successful. One rather promising outlet for very hard pitch is as pulverized fuel, where, in some cases, for metallurgical work, it can compete advantageously with fuel oil. Hard pitch, normally contains less than ½ of 1 per cent ash and only about 1/3 to ½ of 1 per cent sulphur. For these reasons it can be used where pulverized coal would be out of the question on account of much higher ash and sulphur content. Work on another pitch outlet was started by our engineers nearly a year and a half ago, in the line of mixing with coke breeze or non-coking coals to supply the cementing properties necessary for satisfactory coking.

CONCLUSIONS

The future field for gas is in an increased use for general city and industrial service, made possible by more widely extended distribution systems and by replacement of natural gas shortages, also in generating power by means of gas engines.

There is an ample supply of benzol, toluol and homologues now recovered for our present domestic consumption of solvents, chemical derivatives and explosives. After the present abnormal conditions are past, the surplus will find ready use as motor fuel.

New uses for tar must be found for an increased production of 100 per cent within two or three years, unless it is to be used as fuel. Refined derivatives, including phenol, cresols, naphthaline and intermediates, will be produced in sufficient amount to meet the demands of the color, drug and chemical manufacturers. The degree of development in this direction depends on the action of the Government with regard to protective measures and upon the co-operative effort of the industries involved.

The increased amount of creosote oil will tend to keep the price at such a level that European producers will seek to find outlets at home for their surplus.

The outlook for pitch is exceedingly problematical. Although new uses may be confidently looked for, it seems inevitable that a large proportion of pitch must find its outlet in the fuel field.

The by-product coke-oven, besides being an integral part of our steel industries, is our main source of benzol, toluol and phenol for munitions and the wide range of chemicals of scarcely less importance. It is also our only operating native source of combined nitrogen for nitric acid, and the only possible one outside of the costly processes for fixing atmospheric nitrogen. These facts should be recognized by the Government and co-operation for national defense should be established.

Discussion

BY WILLIAM H. BLAUVELT

Consulting engineer Semet-Solvay Company, Syracuse, N. Y.

As the by-product oven replaces the bee-hive in the manufacture of coke, the supply of sulphate of ammonia will increase accordingly, and the supply of sulphate of ammonia may before many years be much more than the 375,000 tons which Mr. Childs gives as the probable production of next year. This amount of sulphate is equivalent to about 587,000 tons of nitric acid of ordinary 40 deg. strength. Even in the emergency of war conditions a certain considerable amount of ammonia must be retained for refrigerating purposes for preserving our food supply. One of the leading authorities in refrigeration work estimates the annual consumption for this purpose to be the equivalent of 14,000 tons of sulphate.

QUESTION OF NITRIC ACID SUPPLY

It is entirely possible, in case of emergency, to withdraw temporarily the sulphate of ammonia ordinarily used for agricultural purposes. It is clear that we have here potentially a very large supply of available nitric acid. Before any large investments are made for plants to produce nitric acid by fixation from the atmosphere, it would seem important that thorough investigation of the relation between the possible requirements and the available supply of nitric acid from present native sources should be made by competent authorities. Such investigation could perhaps best be made by the War Department with the full co-operation

and assistance of the by-product coke producers of the country.

A contract for delivering gas for use in a municipality entails responsibility for continuous service. When a blast furnace goes out for re-lining, or on account of commercial conditions, with a consequent reduction of coke requirements amounting to perhaps 50 per cent or even 100 per cent, the contract for gas to be delivered to a city is a heavy burden. Moreover, candle power requirements are still maintained in many of our States for all gas sold for domestic power, notwithstanding the almost entire disappearance of the flat flame burner, which is the only place where candle power has any real value. The maintenance of 16 or 18 c.p. in oven gas through all the varying conditions of temperature and pressure of domestic distribution requires especial preparation of the gas and a constant study of service conditions. Probably the prevalence of water gas in America has caused us to lag behind Europe in the abolition of candle-power requirements, and although our legislatures move slowly, a number of States have already either much reduced, or abolished candle-power specifications, so that we may have hope of their general disappearance.

COKE OVEN GAS FOR OPEN-HEARTH FURNACES

There are now at least three well-known plants where oven gas is used alone in open-hearth furnaces with entire satisfaction, and with a larger daily tonnage of product than with the usual producer gas fuel. In cases where the gas has been stripped of its benzol, it has been found advisable to replace the luminous quality of the gas with a small amount of tar sprayed into the gas. This restores perfectly the radiating qualities of the flame and makes even the stripped gas an entirely satisfactory open-hearth fuel. Of course, on account of its methane content, oven gas is not preheated for steel furnace work.

Oven gas is also used for open-hearth work mixed with producer gas, and in England and on the Continent a good deal of successful work has been done in using a combination of coke-oven and blast-furnace gas both in the steel furnaces and for gas engines. This mixture of gases in controlled percentages makes it practicable to maintain a very uniform calorific value, which is especially advantageous in gas engine work.

Our statisticians seem to have entirely overlooked the fact that this country has been for years producing millions of gallons of benzol and the other raw materials available for the dye and color industry. Careful estimates from the best data obtainable show that in the year 1914, for example, before any of the recent large construction of benzol recovery plants was in operation, there was produced an amount of benzol quite sufficient, if it had all been applied to these purposes, to furnish all the colors and dyes used in America which have benzol as their source, and our tar distillers have stood ready to furnish all the naphthalene, anthracene, and other materials besides benzol that are employed in making colors, at very moderate prices. For years millions of gallons of benzol have been employed in enriching illuminating gas, for lack of a better market, when the enrichment could have been easily obtained from other sources, and there was practically no market for naphthalene and anthracene for color making purposes.

Our members have one responsibility, however, which must not be overlooked. Proper legislation is necessary to prevent unfair competition from the other side of the water, and to protect the large investments already made here to secure a color industry to this country by the utilization of these important by-products, thereby preventing the paralysis of our great textile industries; and it is the duty of each of us to see that our representatives in Congress are fully informed of our views on this subject.

BENZOL FOR AUTOMOBILES

Mr. Childs has shown the probability of a large amount of benzol being available for automobiles. Considerable propaganda work will, however, have to be done before this fuel can come into general use for motors, since it is hard to convince the general public of the advantage of even the slightest change in any practice to which they have been accustomed. I have operated my own car on it regularly for about four years and find it distinctly superior to gasoline. At present a slight readjustment of the air supply is necessary on most carburetors in changing from gasoline to benzol.

MIXING PITCH WITH COAL FOR COKING

So far as I know no coke containing pitch as part of the coal mixture has as yet been tried in the blast furnace, but the indications are that all the pitch produced from the tar made by the coking plants may be mixed with the coal without disadvantage to the coke, and in the case of many coals, with material benefit.

With the rising costs of coal and labor, the owner of the coke plant must study most carefully the returns from the by-products and be ready to assist in developing their best markets, in order to continue to realize the lowest possible costs of coke.

Fluorspar Production Breaks Record

All records for the amount of domestic fluorspar mined and marketed in the United States were broken in 1915, when 136,941 net tons, valued at $764,475, were sold, compared with 95,116 tons, valued at $570,041, in 1914. Compared with the next highest year, 1912, the output in 1915 represents an increase, according to the United States Geological Survey, of more than 20,000 tons, or nearly 18 per cent. As usual the bulk of the production was sold as gravel spar, the quantity in 1915 amounting to 114,151 tons, or 83 per cent of the total. Sales in 1915 were reported from five states—Illinois, Kentucky, New Hampshire, New Mexico and Colorado.

Notwithstanding that the prices of many mineral products, including steel (the production of which practically controls the fluorspar output), increased during 1915, the value of fluorspar declined. The average price per ton for the whole country, considering all grades, was approximately $5.58 in 1915, as compared with $5.99 in 1914, a decrease of 41 cents a ton. This decline in value has been caused largely as a result of improvements in methods of milling, and in handling larger quantities in the Illinois-Kentucky district. Some may have been sold on contracts at low prices a long time in advance, but it is also believed that the large producers voluntarily kept the price down to a small margin of profit in order to procure and hold for the domestic product Eastern markets which have formerly been supplied largely from abroad.

The imports have been steadily declining for a number of years. In 1915 there were imported into the United States for consumption 7167 net tons, valued at $22,878, compared with 10,205 tons, valued at $38,943 in 1914. The mechanically treated fluorspar from Illinois and Kentucky is of a higher grade than the foreign, and since this mineral is of value chiefly according to its purity, purchasers find that the purer American article is more efficient and consequently cheaper in the end.

The large amount of fluorspar sold in 1915 may be accounted for principally because of the great demand for steel. It is estimated that about 80 per cent of the American fluorspar output, mainly in the form of gravel spar, is consumed in the manufacture of basic open-hearth steel.

The report on fluorspar and cryolite in 1915, by Ernest F. Burchard, will shortly be issued by the United States Geological Survey, at which time a copy may be obtained on application to the Director at Washington, D. C.

The rapidity with which a modern factory building can be erected is demonstrated by the record established by the Samuel Austin & Son Company, Cleveland, Ohio, in constructing a sheet-metal shop for Hubbard & Co., Pittsburgh, Pa. Four days after the fire that destroyed the building which the new structure was to replace the Austin Company submitted designs and estimates for a new building 80 x 500 ft., and entered into a contract calling for completion in 38 working days. The building was completed in 34 working days, or 4 days ahead of the schedule, a section of it 140 ft. long having been turned over to the owner about 10 days earlier.

NEW TRADE PUBLICATIONS

Crusher Repair Parts.—Taylor-Wharton Iron & Steel Company, High Bridge, N. J. Bulletin No. 104-A. Relates to a line of manganese steel repair parts for gyratory and jaw crushers. Illustrations are presented of the various parts that are made of the company's manganese steel and a brief description of the advantages of using this metal is given. Among the parts illustrated are jaw, cheek and toggle plates; toggle bearings, gears, hoppers, wearing plates and chutes, mantle heads, etc.

Motor Trucks.—Locomobile Company of America, Bridgeport, Conn. Brochure. Presents illustrations of a few of the Riker 3 and 4 ton worm-driven trucks in active service, with letters from the owners giving the results of their experience. In this book a pair of pages is given to each truck, an engraving being presented on one with a testimonial letter and a brief statement of the equipment employed and the work done by it on the other. Among the materials handled by the trucks illustrated are building material, crushed stone, lumber, scrap rubber and rubber products, cases of shoes, war munitions, flour, leather, steel beams, pipe and iron and steel products. A partial list of additional users of the trucks is included.

Automatic Sand Blast Machine.—Hoevel Mfg. Corporation, 50 Church Street, New York City. Catalog B 1916. Covers a line of dustless self-contained automatic sand blast machines which are made in a number of different types with stationary nozzles, revolving barrels, rotary tables and rotary floors. All of the various machines are illustrated and briefly described.

Bolts, Nuts and Rivets.—Foster Bolt & Nut Mfg. Company, Cleveland, Ohio. Catalog No. 3. Concerned with a line of carriage, step, cutter and sleigh shoe, fin head, loom, machine, blank, plow, track, stove and elevator bolts; coach, lag and cap screws; wing, tail, hexagon and square nuts; washers, rivets, etc. The different kinds of bolts and nuts are illustrated, a separate page being given to each, with a table of the sizes that can be furnished. Mention is made of the special bolts that can be supplied, as well as the galvanizing and plating work that can be done. A number of tables of useful information are included.

High Vacuum Pumps.—May-Nelson Mfg. Company, 1202 F Street, Washington, D. C.; Eimer & Amend, 205 Third Avenue, New York City, distributers. Bulletin No. 5. Gives a brief description of an oscillating ring high vacuum pump, which consists of only four parts, the body, the impeller, the cover and the shaft. The various advantages such as oil cooling, automatic lubrication, automatic adjustment of impeller clearance and the elimination of the stuffing box are briefly touched upon. The different types of pumps, which are both stationary and portable, are illustrated with brief specification tables. The operating principle of the pump is described, the text being supplemented by a number of diagrams, and instructions for installing and operating the pump are included.

Annealing Boxes.—United Engineering & Foundry Company, Pittsburgh, Pa. Bulletin B. Relates to a line of cast-steel annealing boxes with a curved roof and corrugated and I-beam reinforcement. After a brief historical account of the process of annealing, the various types of boxes which can be supplied are illustrated, together with views of an annealing room showing the charging machine loaded and unloaded and an engraving of an annealing retort in process of machining. Particular stress is laid upon the long life that can be secured from these boxes, mention being made of one that has made 198 trips into the retort and is still in service.

Stoneyard Equipment.—Chicago Pneumatic Tool Company, Fisher Building, Chicago, Ill. Bulletin No. 192. Deals with a line of stone tools and dressers, air compressors and equipment for stoneyards and monumental works. Illustrations of the various tools separately and in service are presented, together with the hose and couplers used in connection with them. Several types of air compressors for belt and internal combustion engine drive are illustrated and briefly described and a condensed table of specifications is included. A directory of the different bulletins which the company has issued, dealing with electric and pneumatic tools, air compressors, etc., is given and mention is made of a self-rotating hammer drill for quarrying, metal mining, etc.

Leather Belting.—Graton & Knight Mfg. Company, Worcester, Mass. Catalog No. 6. Treats of a line of leather products, such as belting, packing, strapping, shoe parts, automobile accessories, etc. The various stages in the conversion of the hide into leather are first described, chiefly by a series of illustrations. The catalog is divided into several sections, each dealing with some one product, that for leather belting containing, for example, a number of views of the various stages in the process, followed by a brief statement of the several grades and lists of the different brands, with reproductions of the trademarks and statements of the uses for which they are particularly adapted. A number of views of belt drives and a considerable number of rules regarding the use of belting are included. In the packing section various types are illustrated with lists of the sizes that can be furnished and the same procedure is followed in the strap and sundry section. A complete alphabetical index renders the finding of any desired article a comparatively easy matter.

Air Compressors and Pneumatic Tamping Tools.—Ingersoll-Rand Company, 11 Broadway, New York City. Two bulletins. The first, No. 3026, contains illustrations and descriptive matter on the Ingersoll-Rogler duplex direct-connected, motor-driven air compressor. Among the principal features of the design are a special disk type of valve, a controller for regulating the amount of clearance, a direct-connected drive, an improved form of intercooler and an auxiliary water separator. In addition to views of the complete compressor, a number of engravings of the various parts are presented. Pressure charts and tables showing the sizes and capacities regularly built are included. The second, No. 9028, describes and illustrates a pneumatic tie tamping outfit, which is useed chiefly in laying new tracks, replacing old tracks and surfacing existing installations, although it can be employed in special applications. Equally effective results are said to be secured with the various materials, such as stone, gravel, earth, cinders, slag, etc., that are used for ballast. Illustrations are shown of the tamper in use and mention is made of a compressor car that has been developed to supply air for the tools.

Rock Drill.—Sullivan Machinery Company, 122 South Michigan Avenue, Chicago, Ill. Bulletin No. 70-C. Shows a mounted hammer rock drill equipped with automatic bit rotating mechanism and water jet. The details of the construction of the drill, which can be used for a wide range of mining, quarrying and contracting work, are gone into at some length, and a number of views of the drill in use are included.

Alternating-Current Generators.—Allis-Chalmers Mfg. Company, Milwaukee, Wis. Two bulletins. The first, No. 1098, superseding No. 1080, pertains to a line of generators designed for direct connection to steam or internal combustion engines. The construction of the generator is gone into at some length, the text being supplemented by engravings of the various parts. Views of a number of installations employing different types of prime movers are included. The other bulletin No. 1099, superseding No. 1075-A, embodies practically the same information for a line of machines designed for belt drive.

Reflectors and Metal Stampings.—Royal Enameling & Mfg. Company, 326 West Madison Street, Chicago, Ill. Catalog and circulars. The former is devoted to a line of porcelain enameled reflectors for incandescent lamps. The various forms in which the reflectors can be supplied are illustrated with tables of the sizes that can be furnished of each. The circulars relate to a line of metal stampings which include arc lamp casings, automobile hub caps and compressed air tanks, cream separator parts, broiler and drip pans and enameled iron table tops. There is practically no text in the circulars, engravings of the various stampings being relied upon to tell the story.

Electric Fans, Hoists and Conduit.—Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City. Folder No. 333 and three bulletins. The folder lists a line of direct-current fans which are made in the oscillating, non-oscillating and ceiling types. Illustrations of different styles are given with tables of the sizes in which they can be supplied. The first bulletin, No. 48,706, calls attention to a line of alternating-current, two and three phase motors and controllers for flat bed and small rotary printing presses. A number of views of the apparatus are presented, together with engravings showing plants in which it has been installed. The second bulletin, No. 48,907, refers to a line of electric hoists for handling loads up to 500 lb. Specifications and a set of dimension tables are given, together with engravings of the hoists with and without a trolley carriage, and a number of views of the hoists in actual use, illustrating the features of labor and time saving and safety, are presented. The third bulletin, No. 49,600, gives general description and specifications for a line of flexible steel conduits, stamped steel boxes and flexible steel armored conductors. The various fittings are illustrated with captions and catalog numbers referring to a table of prices. The advantages of using the armored conductors are briefly touched upon and mention is made of some of the tools that are used in connection with the installation of the armored conductors and metallic conduits.